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The Impact of Early Colleges on Postsecondary Performance and Completion

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Early colleges are a model of schooling that combines the high school and college experiences, providing students the opportunity to simultaneously earn a high school diploma and an associate degree or 2 years of college credit. This article updates findings from a 17-year longitudinal experimental study of the model, examining the impact of the model on postsecondary performance and completion. The study found positive impacts on overall degree completion, with very large impacts on associate degree completion. There were also positive impacts on bachelor's degree completion for low-income students and first-generation college-goers. For students who enrolled in a public 4-year institution, the study found positive impacts on advanced coursetaking. There was no difference between treatment and comparison students on final college GPA or on the percentage of students who double-majored. Treatment students who earned a bachelor's degree did so more quickly than comparison students.

Keywords: *higher education, educational reform, community colleges, postsecondary education, experimental design, quasi-experimental analysis, early college*

Introduction

In response to concerns about the changing nature of the U.S. economy, policymakers have been looking at ways of increasing the number of students enrolling and succeeding in postsecondary education. One of the more innovative approaches has been early colleges, a model that combines aspects of the high school and college experiences so that students can simultaneously earn a high school diploma and an associate degree or 2 years of college credit. Rigorous experimental studies of this approach have shown that the model has positive impacts on high school outcomes and that it increases attainment of postsecondary credentials and reduces time to degree (Edmunds et al., 2012, 2013; Edmunds, Unlu, et al., 2017; Edmunds et al., 2020; Haxton et al., 2016; Song & Zeiser, 2021). The model has dramatically expanded with a recent review finding over 1,000 early college-related high schools and programs across the country (American Institutes for Research, 2024). The model is regularly cited by the U.S. Department of Education as a strong, evidence-based approach (Benson, 2021).

Despite these positive findings, there are questions about whether the model might shortchange students because students spend less time in school. In an early college, students can take 4 or 5 years to do the equivalent of what would normally take students 6 years (4 years of high school plus 2 years of college). In this condensed educational experience, it is possible that students might miss core academic skills or knowledge. This article addresses this question and supplements the existing research by exploring students' academic performance after they leave an early college and enroll in a 4-year institution. This article also updates the existing research by presenting the latest findings on the impact of the early college on students' receipt of postsecondary credentials. As we discuss in more detail below, these outcomes are likely to be influenced by the early college model and are important measures that can mediate impacts on students' longer-term labor market outcomes and economic well-being.

Theoretical Background

Students' success in and completion of postsecondary education are dependent on a variety of factors, including the extent to which they are academically ready for college, often indicated by taking and passing specific courses in high school, as well as the extent to which they exhibit academically oriented skills such as critical thinking, effective communication skills, and problem-solving (Conley, 2005, 2007a, 2007b; Edmunds, Arshavsky, et al., 2017). Researchers have also found that successful college students exhibit an ability to understand and adapt to the culture of college, skills that are less likely to be found among students whose families do not have a history of enrolling in postsecondary education (Collier & Morgan, 2008; Hooker & Brand, 2010; Roderick et al., 2011). Students also need to be able to navigate the logistics of college, including applying to college, applying for and obtaining financial aid, registering for classes, and understanding major requirements (Klasik, 2012; Roderick et al., 2011), and studies have found that completion of these steps can vary substantially by subgroup, with students of color and low-income students less likely to complete many of them (Klasik, 2012).

The Early College Model

Early colleges incorporate many practices that are intended to help students gain the skills and knowledge described above, thereby leading to improved success in college (Edmunds et al., 2022). Serving students in Grades 9–12 or 9–13, the schools aim to provide students with a high school diploma and an associate degree or 2 years of transferable college credit. Early colleges are not necessarily aimed at gifted students; instead, they focus on populations who might otherwise face substantial barriers to attending college such as first-generation students, low-income students, and students who are members of racial and ethnic groups with historically lower levels of participation in postsecondary education.

This article reports results for the model as implemented in North Carolina, where early colleges (known as Cooperative Innovative High Schools) are small high schools of choice, almost always located on college campuses. In North Carolina, each early college was expected to implement and exhibit a specific set of principles, known as design principles—originally developed by North Carolina New Schools (the public–private partnership that managed these schools for the first 13 years)—that represent characteristics of high-quality high schools. These design principles are as follows: (a) College Ready, ensuring that students are ready for college; (b) Powerful Teaching and Learning, supporting rigorous and relevant student-centered instruction; (c) Personalization, including focusing on high-quality staff–student relationships and providing affective and academic supports; (d) Professionalism, embedding ongoing professional development and collaboration into the schools; (e) Leadership, or having distributed leadership focused on a common goal; and (f) Purposeful Design, or the use of school structures to support the other design principles (North Carolina New Schools Project, 2011).[1]

The first three design principles are the ones most directly connected to the outcomes we examine in this article, as shown in the conceptual framework in Figure 1. The College Ready design principle is intended to ensure that each school has a purposeful goal of preparing all its students for college. As part of this principle, schools have a clearly articulated curriculum that could lead to students' receiving all of their high school credits and 2 years of college credit by the end of high school. All students are expected to take college preparatory high school level courses, and all students are also expected to take college courses; for many students, this starts in the ninth grade. This early access to college credits also gives students exposure to the culture of college. Additionally, the schools create a college-going culture using strategies such as college visits or regularly posting and sharing information about college.

Under the Powerful Teaching and Learning design principle, high school teachers use rigorous instructional practices intended to prepare students to be successful in college classes. The early colleges also provide students explicit instruction in college readiness skills, including organizational and time management and self-advocacy skills (Edmunds, Arshavsky, et al., 2017). The Personalization design principle is intended to help students be successful with these higher expectations and includes academic and affective support. Early colleges also have structures, such as seminars or advisories, that provide support to students and help them navigate the college admissions process.

As a result of these early college components, students accumulate a substantial number of college credits while they are in high school (Edmunds et al., 2017). They are also expected to be college-ready and have a better sense of what they would like to pursue in college. As the last column in Figure 1 shows, we expect that these components of the early college model will provide students several advantages when they graduate from high school that should lead to increased degree attainment.

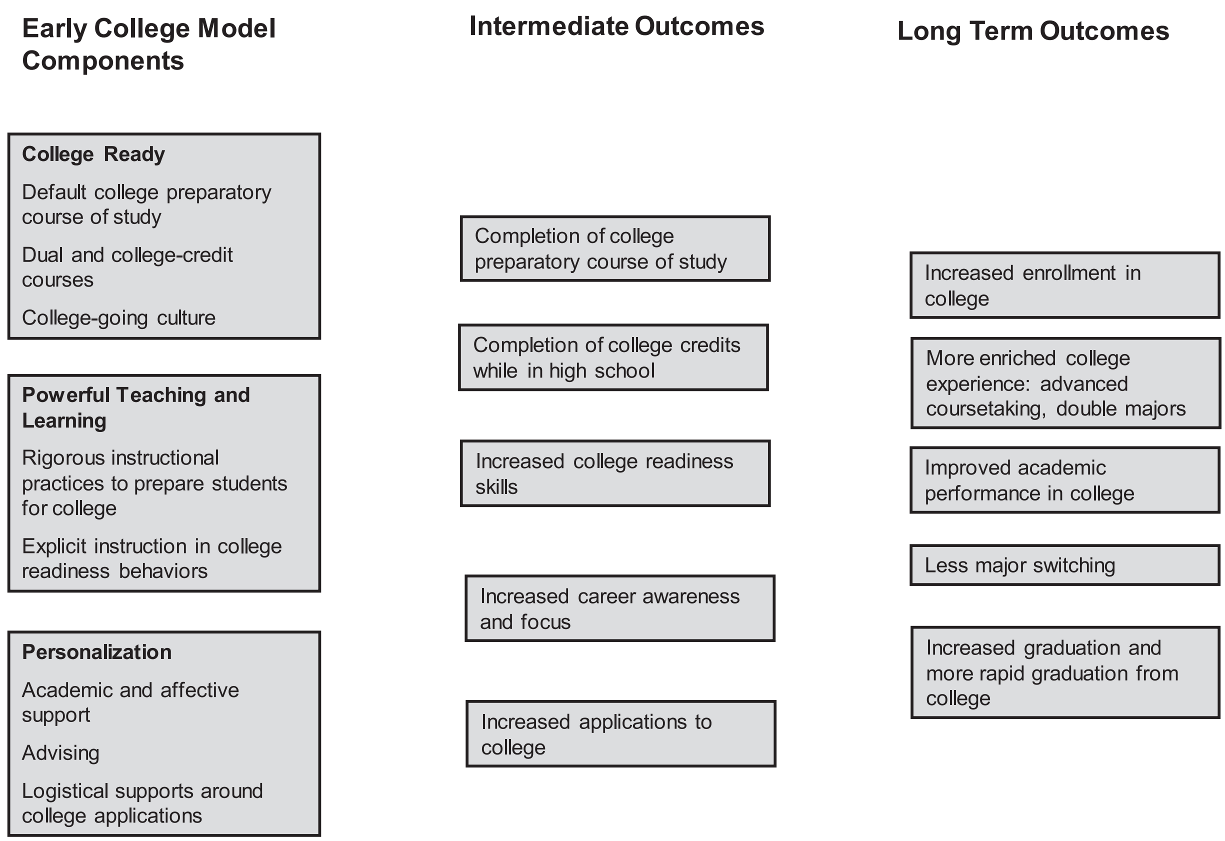

FIGURE 1. *Conceptual framework.*

The ultimate goal of the early college is to ensure that more students enroll in and successfully complete a postsecondary credential. The entire model is intended to help students gain the academic preparation they need, increase their enrollment and success in college, and reduce the amount of time it takes to get a degree. A large driver of the outcomes is likely the college course credits taken in high school, which are intended to provide students with the academic momentum that pushes them to graduate from college (Adelman, 2006; Huntington-Klein & Gill, 2021). Indeed, research has shown that dual enrollment has a positive impact on degree attainment and that the positive impacts of dual enrollment are at least partially if not completely mediated by the academic momentum that students receive (An & Taylor, 2019; Wang et al., 2015).

Previous Evidence on Early Colleges

Research on early colleges, including two rigorous experimental studies, have shown that the model has positive impacts on a range of high school and postsecondary outcomes. At the high school level, early college students have fewer suspensions and better attendance (Edmunds et al., 2013) and are significantly more likely to take courses needed for entrance into a 4-year college (Edmunds et al., 2012). They also earn many more college credits in high school than control students (Edmunds et al., 2017).

At the postsecondary level, early college students are more likely to enroll in postsecondary education (Edmunds et al., 2017; Haxton et al, 2016) and are more likely to receive a postsecondary credential (Edmunds et al., 2020; Song & Zeiser, 2021). Our previous research has shown that the impacts are much larger on 2-year degree attainment with small, and nonsignificant, overall impacts on bachelor's degrees and that early college students who earned degrees did so more rapidly than control students (Edmunds et al., 2020). These findings were for approximately half of our sample because the more recent cohorts had not yet had enough time to complete college. Results also showed that there were no significant differences in college grade point average (GPA) between early college and comparison students (Edmunds et al., 2020). This article updates the previous findings by looking at postsecondary completion rates for all students in our sample and by examining additional postsecondary outcomes.

Case for the Current Article

As noted above, we have already published research related to postsecondary credentials and limited measures of postsecondary performance (Edmunds et al., 2020). This article expands on the previously published results in a variety of ways. First, the previously published results on postsecondary credential attainment included 1,067 students who applied to 12 early colleges from 2005–2006 through 2008–2009. This article includes degree findings for our full sample of students: 4,073 students who applied to 19 early colleges in North Carolina and entered ninth grade in the period from 2005–2006 through 2010–2011. Second, the previously published paper only looked at a single measure of postsecondary performance: GPA for the beginning of college. For this article, we update these GPA analyses and look at GPA by the time a student received a bachelor's degree. We also include additional measures of performance that we have not previously reported, including advanced coursetaking and double-majoring.

We explore the impact of the model on additional measures of postsecondary performance because, although getting students through to a degree in less time can be seen as a desirable outcome, some policymakers and practitioners may be concerned about whether students are being shortchanged in some way—whether an emphasis on speed and efficiency might mean that students are learning less or might derive less academic benefit from their schooling experience. We look at three measures of academic performance in the 4-year college setting: (a) the level of courses students take, (b) the number of majors students have, and (c) students' academic achievement. We also provide updated analyses of time-to-degree for bachelor's degree recipients. The early college model may impact these postsecondary outcomes in a variety of ways.

As part of the model, early college students complete a large number of college courses in high school. Descriptive analyses of state-level data show that the average early college student has earned approximately 32 transferable college credits by the end of 12th grade. These courses are part of a pathway that provides students with the credits they need for an associate degree and to meet the general education course requirement of North Carolina 4-year public institutions. Completing these courses in high school should allow early college students to take more advanced or higher-level courses once they enroll in a 4-year institution. Although this expectation appears self-evident, there is little empirical research on whether taking dual enrollment courses results in students taking higher-level college courses. However, research on Advanced Placement courses (also college-level courses taken in high school) has shown that providing students credit for introductory-level courses promotes their likelihood of taking more advanced courses when they later enroll in college (Ackerman et al., 2013; Evans, 2019; Gurantz, 2019).

Early exposure to college courses could also result in students gaining a better understanding of their areas of interest. Taking most of their general education courses in high school might have allowed students to identify subjects in which they were more or less interested. It is therefore possible that early college students would be less likely to switch majors, a situation that has been associated with longer time to degree (Yue & Fu, 2017), particularly if the major switching occurs later in a students' experience (Liu et al., 2021). Focusing more clearly on a major and taking more advanced courses may also make it easier for early college students to take a second major without extending their time in college; second majors have been associated with benefits such as positive labor market returns (Hemelt, 2010).

Third, it is possible that the early college might have better prepared students academically, which might allow them to do better in college courses. This theory is supported by research finding that dual enrollment participation results in a higher college GPA for students (An & Taylor, 2019). A competing hypothesis, and one related to the shortchanging concerns, is that early college students miss core content because of their truncated educational experience. Previous analyses have shown that the early college has no impact on postsecondary GPA within the first 2 years of enrollment (Edmunds et al., 2020). This article updates those findings by looking at cumulative GPA by receipt of a bachelor's degree.

As noted earlier, the early college is particularly focused on students who have historically been underrepresented in college, including students who are the first in their family to go to college, students who are members of racial and ethnic groups underrepresented in college, and students who are economically disadvantaged. The theory is that these students will benefit most from the additional supports and higher expectations of the model. Indeed, our earlier results found the largest impact on bachelor's degree attainment was on students who were economically disadvantaged with similar impacts for most other subgroups (Edmunds et al., 2020). As a result, we also examine impacts for these populations.

The specific research questions thus explore the main hypotheses for the early college's impact on educational attainment and on postsecondary performance in a 4-year institution. Our first core question is the impact on educational attainment.

1. What are the impacts on students' attainment of postsecondary credentials? How does that impact differ by subgroups?

We used our full sample of 4,073 students to answer this question. We explored these impacts overall, for the three early college target populations, and for students who applied to early colleges hosted at 2-year versus 4-year postsecondary institutions. The next set of questions then seeks to understand whether there were any positive or negative impacts on students' postsecondary experience resulting from the early college model.

2. What is the impact of the early college on the number of advanced courses taken by students in a 4-year institution?
3. What is the impact on the number of majors in which a student enrolls?
4. What is the impact on time to degree for bachelor's degree recipients?
5. What is the impact on students' postsecondary GPAs?

Data to answer these questions were only available for the students who enrolled in the University of North Carolina (UNC) System, so we were restricted to approximately one-third of the full sample for questions pertaining to students who enrolled at these institutions and approximately one-fifth of the full sample for questions about students who earned a bachelor's degree from a UNC System institution. Owing to these smaller sample sizes, we did not analyze these research questions by student subgroups.

Methods

The study is based on a randomized controlled trial with 19 North Carolina early colleges that had more applicants than they could accommodate. Students applied to attend the early college and went through a screening process determined by the individual school. A lottery was conducted with the eligible students in which students were randomly selected to either attend the early college or to attend the business-as-usual schooling experience, normally the regular comprehensive high school in the district. Seventeen of the early colleges were partnered with community colleges, and two of them were partnered with 4-year universities.

Data Sources

Our core dataset used application data from participating schools that were linked by the North Carolina Education Research Data Center (NCERDC) at Duke University to K–12 data from the North Carolina Department of Public Instruction. To determine the impact on postsecondary credential attainment, we linked students' names and birthdates from the application data to data from the National Student Clearinghouse (NSC), which provides information on enrollment and degree attainment for students in public and private institutions nationwide. These data were then linked by NCERDC to the study dataset.

Postsecondary performance measures came from data provided by UNC System. NCERDC then linked these data to our core data set. The K–12 data included a rich array of demographic (e.g., race/ethnicity), socioeconomic (e.g., economically disadvantaged status), and achievement (e.g., exam scores) variables measured prior to student enrollment in an early college or comprehensive high school. The UNC System data we received included academic information on enrollments, majors, courses taken, grades earned, and degrees received from the 2009–2010 year through the 2019–2020 year.

Sample

We used two core samples in this article. Our full dataset, including all students who were randomized to attend an early college, was the sample used to analyze the impacts of the model on postsecondary credential attainment (the first research question). This sample included 4,073 students who applied to 19 early colleges in North Carolina and entered ninth grade in the period from 2005–2006 through 2010–2011.

Research Questions 2, 3, 4, and 5 focus on students' performance once they leave the early college and enter a 4-year college. Because we utilized detailed coursetaking data to answer several of these questions, we needed to limit our original sample to the 1,300 students who enrolled in a UNC System school after leaving the early college. For analyses of outcomes for students who enrolled for 2 years or who earned a bachelor's degree, we further restricted the sample to students who advanced to those points at a UNC System institution. The process used to create these samples is described in more depth in the analysis section.

Measures

For this article, we examined outcomes measured after students left the early college in two outcome domains. First, we examined students' completion of a postsecondary credential. Then, we examined postsecondary performance, looking at students' coursetaking patterns, their majors, their time to degree, and their GPA. All of these are important outcomes that can influence students' longer-term employment and economic well-being. We looked at all outcomes through 10 years after a student entered ninth grade.

Postsecondary Credential. The first outcome is attainment of a postsecondary credential. We used data from the NSC with the full sample of originally randomized students. We looked at credential attainment within 10 years of entering ninth grade (typically equivalent to within 6 years of completing 12th grade), first looking at the percentage of students who earned any sort of postsecondary credential and then breaking it out by the different credential types including associate, bachelor's, and short-term credentials.[2] The NSC reports the type of credential and the date it was received. Students who were not located in the NSC data were considered to have not been enrolled in college and to have not received a degree.

We looked at credential attainment for the full group of the students as well as for four pairs of mutually exclusive subgroups of students: (a) students who identified as members of racial or ethnic groups historically underrepresented in college (i.e., Black, Hispanic or Native American) and students who were not members of racial or ethnic groups historically underrepresented in college (i.e., Asian, White, or multiracial), (b) students who would be the first in their family to go to college and students who would not be the first in their family to go to college, (c) students who were identified as economically disadvantaged and students who were not economically disadvantaged, and (d) students participating in lotteries at early colleges hosted at 2-year postsecondary institutions and students in lotteries at early colleges hosted at 4-year postsecondary institutions.

Advanced Coursetaking. With respect to coursetaking, we sought to determine whether early college students were more likely to take advanced levels of courses. We developed a measure of advanced coursetaking that changed depending on how many years a student had been in school. According to the UNC System, courses taught at the 100 or 200 levels are considered lower division courses (UNC System Office, 2021); however, it is not necessarily reasonable to expect students who are just starting in college to take courses at the 200 level. As a result, we defined two different advanced coursetaking levels that we applied at three different time points using the course expectations from a representative college from the UNC System (University Registrar's Office, 2022). First, we looked at the number of credits earned in courses at or above the 200 level taken in the 1st year of enrollment post–high school in a UNC System school (courses with numbers 100–199 are intended primarily for freshman). The sample for this analysis was all students who took at least one course in Year 1 with nonmissing GPA data. Second, we examined the number of credits earned in courses taken earned at or above the 300 level in the second year of enrollment (courses with numbers 200–299 are intended primarily for sophomores). The sample for this analysis was all students who took courses in Year 1 and Year 2 with nonmissing GPA data. The final analysis was the share of credits earned at or above the 300 level (or upper division courses) for students who received a bachelor's degree from a UNC System school. Collectively these three outcomes provide insights into students' advanced coursetaking in college.

Majors. We considered four outcomes with respect to majors, all analyzed for the sample of students who earned a bachelor's degree from a UNC System school. The first was the percentage of students who had more than one major at some point in their college career. The second was the number of semesters it took students to declare a major. The third was the percentage of bachelor's degree recipients who switched majors at any point while at a UNC System school, and the fourth was a count of the total number of major switches. The second through fourth outcomes all could be considered measures of the extent to which the early college experience helped students clarify their interests and more quickly focus their studies. For all measures related to majors, we drew on information in UNC System enrollment files that report, by term, the Classification of Instructional Programs (CIP) code associated with the student's first and, if applicable, second major. A student with CIP code information for a second major at any point was coded as ever double-majoring. Students connected with more major CIP codes while enrolled as an undergraduate than their maximum *concurrent* number of declared majors over their terms of enrollment were considered as major-switchers. We calculated *major-switches* per student by subtracting the maximum *concurrent* number of declared majors from the total number of major CIP codes to which the student was connected.

Time to Degree. We assessed time to a bachelor's degree for the set of students who earned a bachelor's degree from a UNC System institution within 10 years of entering high school. We calculated time to degree as the number of school years after a student's expected 12th-grade year that it took for the student to earn a bachelor's degree. For example, for a student entering ninth grade in 2005–2006, expected to be in 12th grade in 2008–2009, and earning a bachelor's degree in the spring of 2014, time to degree was 5 years.

Academic Achievement. Another aspect of postsecondary performance is students' GPAs, which can serve as a measure of the extent to which students have learned sufficient academic content and developed skills that allow them to be successful in college classes. Specifically, we examined cumulative GPA measures at three time points after students left the early college or regular high school: (a) through students' 1st year at the UNC System, (b) through students' 2nd year at the UNC System (these two years were required to be consecutive), and (c) at the time of a bachelor's degree. The sample for each analysis included all students who had outcome data for that period of time. Because GPA may differ depending on the level of courses, we also looked at GPAs only for advanced courses and found similar results.

Analyses

As noted above, the original study design used a randomized controlled trial comparing outcomes for students who applied to and were randomly accepted to the early college with students who applied to and were randomly not accepted. The postsecondary degree attainment outcome used this original sample. To look at the impact on bachelor's degrees, for example, we used degree attainment as the dependent variable in multivariate regression models that included lottery indicators reflecting the blocks of students within which the randomization was done, baseline covariates (demographics and measures of prior achievement listed above), and a treatment group indicator, which yielded the estimated impact of the early college on that outcome. We used an intent-to-treat (ITT) framework, wherein students remained in their originally assigned group regardless of whether they enrolled or later left the early college. We had overall strong compliance with the initial random assignment (92% among treatment students and 99% among control students). Students were weighted according to their probability of being assigned to the treatment group (Imbens & Rubin, 2015; Institute of Education Sciences, 2018) and we used cluster-robust standard errors calculated based on the early college or the regular high school that students attended for the longest period of time. We repeated these analyses for the subgroups of interest.

All of our other performance outcomes (advanced coursetaking, majors, time to degree, GPA), however, were assessed only for students who enrolled (or earned a degree) from the UNC System, for whom all of these measures were available. Because students were not randomly assigned to enroll in a UNC institution and because we have previously found that attending an early college had a positive and statistically significant impact on attending a UNC institution (Edmunds et al., 2020), the treatment and control group members for whom the outcome measures were available were no longer directly comparable.

Table 1 shows how the sample sizes and characteristics of treatment and comparison groups varied by analytic sample. For example, columns 5 and 6 show that 33.9% of treatment students in the full randomized control trial (RCT) sample were in our analyses of Year 1 outcomes at UNC System schools versus 29.2% of comparison students, and that there were sizeable differences in the observable characteristics of these treatment and control students. Specifically, treatment students in our Year 1 UNC analyses were more likely than control students to be economically disadvantaged (40.8% treatment vs. 36.1% control) and to have lower scores on eighth grade exams. Rates of economic disadvantage declined, while average baseline exam scores rose for both treatment and comparison groups as the sample sizes declined as we progressed to analyzing Year 2 outcomes and outcomes for students earning a bachelor's degree from a UNC System school. We note that baseline exam scores were lower, on average, among treatment and comparison students enrolling at *any* 4-year postsecondary institution (columns 3 and 4) than among UNC System enrollees, suggesting that it was *not* that case that the highest-achieving students enrolled at schools outside our sample. Moreover, we see that treatment students remained more likely to enroll at a 4-year institution when accounting for private and out-of-state enrollments.

Since using the original experimental design for postsecondary outcomes assessed for UNC System enrollees was not feasible, this article utilized a quasi-experimental propensity score weighting approach in which treatment students who enrolled in a UNC System school after graduating from an early college were weighted on observable characteristics to more closely resemble the control students who enrolled in a UNC System school. Therefore, this analysis is expected to yield the effect of early colleges on the outcomes of interest for students who would have enrolled in the UNC System even in the absence of the program. In other words, the results of these analyses do not necessarily pertain to treatment students who were *induced* to enroll in a UNC System school by the early college model because UNC postsecondary performance measures for their counterparts in the control groups are missing by definition. This approach is identical to the one we used in our previously published GPA analyses (Edmunds et al., 2020).

Given the differences in the number of students in each of our analytic samples and the differences in their average characteristics, we implemented weighting separately for each sample through a multistep process. At a high level, the propensity score weighting approach aimed to weight the treatment group so that, on average, their observable characteristics were similar to the average observable characteristics of the comparison group. Thus, treatment students who looked more similar to the typical comparison group students received larger weights than those whose observable characteristics were less similar.

The first step in our analytic process was *estimation of the propensity scores* for the treatment group. In this case, the propensity score represented the probability of being in the comparison group as a function of baseline covariates that were considered to predict enrolling at a UNC System school. Our covariates included demographics (race/ethnicity, gender, age, economic disadvantage, first-generation college-going status, having a disability, being identified as academically or intellectually gifted); baseline indicators of student achievement (being retained in a prior grade, scores on eighth-grade math and reading end-of-course exams, passing Algebra I in eighth grade, and teachers' assessment of eighth-grade achievement in math and reading); eighth-grade absences (to proxy for academic engagement and motivation); and additional factors that we expected to predict enrolling in UNC System schools, such as academic performance of their eighth-grade middle schools, district-level baseline high school graduation rates, and the number of colleges in their eighth-grade county.

We estimated the propensity scores using generalized boosted modeling (GBM; McCaffrey et al., 2013). GBM combines boosting (i.e., iterations) and regression trees (which partition the dataset into numerous regions based on the covariate values). GBM is data adaptive and nonparametric; it automatically selects which covariates should be included and the best functional form by using many piecewise functions of the covariates and testing all possible interactions to achieve the best balance between the treatment and comparison units. GBM also accommodates missing values

TABLE 1

Baseline Characteristics of Treatment and Comparison Groups, by Sample

	Full RCT Sample		Enrolled at Any 4-Year School		Enrolled at UNC System School		Enrolled at UNC System School 2 Consecutive Years		Earned Bachelor's Degree at UNC System School	
Baseline Characteristic	T	C	T	C	T	C	T	C	T	C
N	2,345	1,728	1,192	803	796	504	651	414	493	295
% of full RCT sample	100.0%	100.0%	50.8%	46.5%	33.9%	29.2%	27.8%	24.0%	21.0%	17.1%
Black	27.3%	26.6%	31.8%	33.1%	33.1%	34.5%	32.4%	32.9%	32.4%	30.8%
White	59.0%	60.6%	56.1%	56.3%	57.4%	55.6%	58.1%	57.8%	58.8%	58.6%
Hispanic	8.5%	7.1%	6.3%	4.8%	4.7%	3.4%	4.7%	3.5%	4.5%	4.6%
Male	40.1%	39.8%	37.1%	37.0%	38.2%	39.9%	38.3%	40.6%	35.6%	38.7%
First-generation college-going	39.0%	41.3%	31.0%	31.1%	29.5%	29.2%	30.0%	30.7%	29.4%	29.9%
Economically disadvantaged	51.0%	49.1%	44.6%	40.9%	40.8%	36.1%	39.6%	33.3%	38.8%	31.2%
Gifted status	14.4%	14.4%	18.6%	21.8%	21.4%	25.8%	23.6%	27.6%	24.6%	29.9%
Special education status	1.8%	2.2%	0.6%	1.5%	0.5%	1.8%	0.6%	2.2%	0.6%	1.4%
Age	15.31	15.34	15.22	15.22	15.20	15.18	15.22	15.18	15.21	15.18
Eighth-grade English score (z-scored)	0.00	−0.02	0.23	0.26	0.32	0.42	0.36	0.45	0.40	0.46
Eighth-grade math score (z-scored)	−0.01	0.00	0.26	0.29	0.35	0.40	0.39	0.47	0.40	0.52

Note. T indicates treatment group accepted via lotteries to an early college; C indicates comparison group not accepted to an early college; means are weighted by the inverse of students' probability of being selected into the early college; enrollments and degree completions must have occurred within 6 years of the student being in 12th grade. UNC enrollment samples require nonmissing GPA data for inclusion in samples. We also exclude from all UNC samples used for quasi-experimental analyses students missing baseline covariates for race/ethnicity, economic disadvantaged status, and eighth-grade English exam scores.

for covariates by balancing both the distribution and the rates of missingness of each covariate between the treatment and comparison arms. We implemented GBM using the *twang* package in Stata (Cefalu et al., 2015).

The second step was *calculating weights* for the treatment students in each postsecondary performance sample so that they looked similar to the control students in that sample. Following Stuart (2010), control students were weighted by 1, and treatment students were weighted by $\frac{\hat{P}}{1-\hat{P}}$ where $\hat{P}$ was the estimated propensity score.

The final step was *assessing baseline equivalence*. For each sample and covariate, we examined standardized differences (i.e., effect sizes) between the weighted treatment and control students (Rosenbaum & Rubin, 1985; What Works Clearinghouse, 2022). Table 2 shows baseline equivalence for the sample enrolling at UNC System schools, Table 3 shows baseline equivalence for the sample of students persisting to a second year, and Table 4 shows baseline equivalence for the sample that earned a bachelor's degree from a UNC System school. In each table, the first column shows the shows the unweighted mean for the treatment group, the second column shows the weighted treatment group mean, and the third column shows the control group mean. The fourth and fifth columns show the unweighted and weighted standardized differences between the treatment and control groups. We see in these tables that the weighting procedure was successful in reducing the baseline differences so that none of the weighed standardized differences were larger than 0.1 standard deviations and most were smaller than 0.05 standard deviations. As such, all samples met baseline equivalence expectations according to the federal What Works Clearinghouse.[3]

To calculate the impact of the early college model, we used weighted multivariate regression models that included as covariates all of the baseline measures used in the estimation of propensity scores, essentially estimating "doubly robust" models. We used cluster-robust standard errors at the high school level to take into account the clustering of students within schools. Missing covariate values were imputed using Stata's multiple stochastic imputation module *mi*. This approach is consistent with the current best practices in the field and What Works Clearinghouse standards. We accounted for multiple imputed values for missing covariates in our impact analysis by running estimation models using the *mi* module, which implements Rubin's rule to pool estimates from regressions run on each of the imputed datasets (Rubin, 1987). We did not impute missing outcome data.

Results and Discussion

Overall, our results show that early college students had the same or better postsecondary performance than control students after they left the early college.

Impact on Postsecondary Credential Attainment

Our first outcome focuses on attainment of different postsecondary credentials and used the original randomized sample. As shown in Table 5, early college students were more likely to attain a postsecondary credential, and this was driven primarily by a very large impact on attainment of associate degrees with early college students 2.7 times (23 percentage points) more likely to have earned an associate degree than control students. Despite this large impact on associate degree attainment, it does not appear that students were being diverted from 4-year degrees as there was a small positive overall impact, although the results were not significant at the traditional $p \leq .05$ level.

We also broke out the results by subgroups. Table 6 presents the impacts for eight primary subgroups: first-generation and not first-generation; underrepresented racial and ethnic groups (Black, Hispanic, Native American) and not underrepresented groups (Asian, White, and multiracial); economically disadvantaged students and not economically disadvantaged students; and students in the lotteries at early colleges hosted at 4-year versus 2-year postsecondary institutions. The table also looks at the differential impact between the two related subgroups (e.g., first-generation and not first-generation) to see if one group was benefitting more.

As Table 6 shows, all subgroups but one had large positive impacts on overall degree attainment and particularly on associate degree attainment. The exception is the small ($N=253$) subgroup of students in lotteries at early colleges hosted at 4-year postsecondary institutions; just 2 schools in our sample of 19 early colleges were at these institutions. Four of the groups also had statistically significant positive impacts on bachelor's degree attainment: first-generation college-goers, economically disadvantaged students, students who were not members of underrepresented racial and ethnic groups, and students attending early colleges hosted at two-year colleges. When we compare impacts across subgroups, we see that the impacts on associate degree attainment were larger for students in lotteries at early colleges hosted at 2-year institutions as well as for the populations that were not underrepresented in college. Part of the explanation for these latter findings may be that the model resulted in some students getting an associate degree who might otherwise have gone directly into a 4-year institution. To test this hypothesis, we replicated our main analyses for four mutually exclusive categories: (a) students who earned only a technical credential, (b) students who earned only an associate degree, (c) students who earned only a bachelor's degree, and (d) students who earned both an associate and bachelor's degree. The overall results of these analyses are reported in Table 7.

As Table 7 shows, early college students were much more likely to earn only an associate degree as well as both an associate and a bachelor's; more than half of the early

TABLE 2

Baseline Characteristics of Treatment and Comparison Groups, Students Enrolling at UNC System Schools Within 6 Years Post–High School

	Treatment Group Mean ($N=796$)			Treatment and Comparison Group Standardized Difference	
Baseline Characteristic	Without PS Weights	With PS Weights	Control Group Mean ($N=504$)	Without PS Weights	With PS Weights
Black	33.1%	32.6%	34.5%	−0.03	−0.04
White	57.4%	58.9%	55.6%	0.04	0.07
Hispanic	4.7%	3.7%	3.4%	0.06	0.02
Male	38.2%	39.8%	39.9%	−0.04	0.00
First-generation college-going	29.5%	29.8%	29.2%	0.01	0.01
Economically disadvantaged	40.8%	38.4%	36.1%	0.10	0.05
Gifted status	21.4%	25.8%	25.8%	−0.10	0.00
Special education status	0.5%	0.8%	1.8%	−0.13	−0.09
Age	15.20	15.18	15.18	0.07	0.00
Retained before ninth grade	0.5%	0.4%	0.6%	−0.02	−0.04
Passing Algebra 1 in eighth grade	35.1%	37.2%	36.4%	−0.03	0.02
Eighth-grade English score (z-scored)	0.32	0.44	0.42	−0.10	0.02
Eighth-grade math score (z-scored)	0.35	0.43	0.40	−0.06	0.03
Seventh-grade English score (z-scored)	0.31	0.40	0.38	−0.08	0.02
Seventh-grade math score (z-scored)	0.28	0.43	0.47	−0.20	−0.05
Teacher assessment of English achievement (eighth grade; scale = 1–4)	3.47	3.52	3.52	−0.09	0.00
Teacher assessment of math achievement (eighth grade; scale = 1–4)	3.40	3.45	3.42	−0.04	0.05
Average absences during middle school (days)	5.31	5.35	5.37	−0.01	−0.01

Note. PS = propensity score. This table reflects baseline equivalence for students who took at least one course at a UNC System school at in the first 6 years after 12th grade and had nonmissing GPA data. We exclude students missing baseline covariates for race/ethnicity, economic disadvantaged status, and eighth-grade English exam scores for the analysis. Means and standardized differences "without PS weights" include weights reflecting the inverse of students' probability of being selected into the early college only. We account for these RCT design weights in estimating propensity score weights used in the "with PS weights" columns.

TABLE 3

Baseline Characteristics of Treatment and Comparison Groups, Students Enrolling at UNC System Schools for 2 Consecutive Years Within 6 Years Post–High School

Baseline Characteristic	Treatment Group Mean (N=651) Without PS Weights	Treatment Group Mean (N=651) With PS Weights	Control Group Mean (N=414)	Treatment and Comparison Group Standardized Difference Without PS Weights	Treatment and Comparison Group Standardized Difference With PS Weights
Black	32.4%	31.2%	32.9%	−0.01	−0.04
White	58.1%	60.7%	57.8%	0.01	0.06
Hispanic	4.7%	3.8%	3.5%	0.06	0.01
Male	38.3%	40.7%	40.6%	−0.05	0.00
First-generation college-going	30.0%	30.0%	30.7%	−0.01	−0.02
Economically disadvantaged	39.6%	36.1%	33.3%	0.13	0.06
Gifted status	23.6%	27.5%	27.6%	−0.09	0.00
Special education status	0.6%	1.1%	2.2%	−0.15	−0.09
Age	15.22	15.20	15.18	0.09	0.04
Retained before ninth grade	0.5%	0.3%	0.7%	−0.04	−0.06
Passing Algebra 1 in eighth grade	36.5%	37.8%	38.4%	−0.04	−0.01
Eighth-grade English score (z-scored)	0.36	0.47	0.45	−0.09	0.02
Eighth-grade math score (z-scored)	0.39	0.48	0.47	−0.09	0.01
Seventh-grade English score (z-scored)	0.33	0.44	0.43	−0.11	0.01
Seventh-grade math score (z-scored)	0.33	0.47	0.52	−0.21	−0.06
Teacher assessment of English achievement (eighth grade; scale = 1–4)	3.49	3.55	3.54	−0.10	0.01
Teacher assessment of math achievement (eighth grade; scale = 1–4)	3.42	3.48	3.46	−0.08	0.03
Average absences during middle school (days)	5.07	5.15	5.15	−0.02	0.00

Note. PS = propensity score. This table reflects baseline equivalence for students who took at least one course at a UNC System school in 2 consecutive years in the first 6 years after 12th grade and who had nonmissing GPA data. We exclude students missing baseline covariates for race/ethnicity, economic disadvantaged status, and eighth-grade English exam scores for the analysis. Means and standardized differences "without PS weights" include weights reflecting the inverse of students' probability of being selected into the early college only. We account for these RCT design weights in estimating propensity score weights used in the "with PS weights" columns.

college students who had bachelor's degrees also had associate degrees. In contrast, they were much less likely than control students to earn only a bachelor's degree. We then repeated the mutually exclusive categories for our subgroups (Table 8) to see if this helped explain the larger impacts on associate degree attainment for the nontargeted populations. As shown in Table 8, we see that the nontargeted populations had larger impacts for the two outcomes related to associate degrees: (a) earning only an associate degree and (b) earning both an associate degree and a bachelor's degree. In contrast, the impacts on earning only a bachelor's degree were significantly less negative for first-generation and economically disadvantaged students. This suggests that some of the nontargeted populations (not economically disadvantaged and not first-generation) were getting an associate degree that they might not otherwise have received. Future qualitative research would be useful to explore the reasons behind these findings, including how the early college has changed students' perceptions of the different types of degrees.

Given that students who attended early colleges earn more postsecondary credentials, we now shift our focus to the quality of that postsecondary experience in a 4-year institution.

Impact on Advanced Coursetaking

We anticipated that the large number of dual enrollment courses taken by early college students would allow them to take more advanced courses. This is, in fact, what we see. As shown in Table 9, early college students earned statistically significantly more credits in higher-level courses at all three time points we examine. During their 1st and 2nd years, treatment students earned between three and four more credits in advanced courses—the equivalent of one additional course. Looking only at students who received bachelor's

TABLE 4

Baseline Characteristics of Treatment and Comparison Groups, Students Earning a Bachelor's Degree at UNC System Schools Within 6 Years Post–High School

Baseline Characteristic	Treatment Group Mean (*N*=493)		Control Group Mean (*N*=295)	Treatment and Comparison Group Standardized Difference	
	Without PS Weights	With PS Weights		Without PS Weights	With PS Weights
Black	32.4%	30.4%	30.8%	0.03	−0.01
White	58.8%	62.0%	58.6%	0.00	0.07
Hispanic	4.5%	3.7%	4.6%	0.00	−0.05
Male	35.6%	37.9%	38.7%	−0.07	−0.02
First-generation college-going	29.4%	30.6%	29.9%	−0.01	0.01
Economically disadvantaged	38.8%	35.4%	31.2%	0.16	0.09
Gifted status	24.6%	28.8%	29.9%	−0.12	−0.02
Special education status	0.6%	0.5%	1.4%	−0.09	−0.10
Age	15.21	15.20	15.18	0.07	0.05
Retained before ninth grade	0.2%	0.2%	0.7%	−0.08	−0.09
Passing Algebra 1 in eighth grade	36.6%	37.9%	39.5%	−0.06	−0.03
Eighth-grade English score (z-scored)	0.40	0.45	0.46	−0.07	−0.02
Eighth-grade math score (z-scored)	0.40	0.49	0.52	−0.12	−0.03
Seventh-grade English score (z-scored)	0.36	0.41	0.42	−0.07	−0.02
Seventh-grade math score (z-scored)	0.34	0.47	0.54	−0.22	−0.07
Teacher assessment of English achievement (eighth grade; scale=1–4)	3.51	3.56	3.54	−0.06	0.03
Teacher assessment of math achievement (eighth grade; scale=1–4)	3.44	3.49	3.48	−0.06	0.03
Average absences during middle school (days)	4.97	5.06	4.91	0.01	0.04

Note. PS=propensity score. This table reflects baseline equivalence for students who earned a bachelor's degree at a UNC System school in the first 6 years after 12th grade and who had nonmissing GPA data. We exclude students missing baseline covariates for race/ethnicity, economic disadvantaged status, and eighth-grade English exam scores for the analysis. Means and standardized differences "without PS weights" include weights reflecting the inverse of students' probability of being selected into the early college only. We account for these RCT design weights in estimating propensity score weights used in the "with PS weights" columns.

TABLE 5

Postsecondary Credential Impact Estimates, 6 Years After 12th Grade

Outcome	Adjusted Treatment Mean (*N*=2,345)	Unadjusted Control Mean (*N*=1,728)	Impact Estimate (*SE*)	*p*-Value
Any postsecondary credential	48.5%	36.4%	12.1 pp (2.2 pp)	<.001
Technical credential	3.3%	3.9%	−0.6 pp (0.7 pp)	.324
Associate degree	37.0%	13.8%	23.2 pp (2.9 pp)	<.001
Bachelor's degree	27.5%	25.1%	2.4 pp (1.4 pp)	.097

Note. Cluster-robust standard errors at the high school level are presented in parentheses. pp = percentage point.

TABLE 6

Postsecondary Credential Impact Estimates by Subgroup, 6 Years After 12th Grade

Outcome		First Generation		Underrepresented Race/ Ethnicity		Economically Disadvantaged		Postsecondary Partner	
		First Gen. (*N*=1,373)	Not First Gen. (*N*=2,051)	Underrep. (*N*=1,430)	Not Underrep. (*N*=2,597)	EDS (*N*=1,928)	Not EDS (*N*=1,927)	Four-Year Hosted (*N*=253)	Two-Year Hosted (*N*=3,820)
Any postsecondary credential	Control mean	30.0%	41.9%	31.8%	39.1%	26.1%	47.2%	51.9%	35.5%
	Impact	11.4pp****	12.2pp****	8.5pp****	14.5pp****	13.3pp****	10.7pp****	0.2pp	12.8pp****
	Differential impact	−0.8pp		−5.9pp*		2.6pp		−12.6pp**	
Associate degree	Control mean	14.1%	13.6%	8.3%	16.7%	10.8%	16.7%	7.8%	14.1%
	Impact	20.6pp****	27.8pp****	16.4pp****	27.5pp****	18.9pp****	27.7pp****	−2.6pp	24.9pp****
	Differential impact	−7.2pp		−11.1pp***		−8.8pp*		−27.5pp****	
Bachelor's Degree	Control mean	16.7%	32.0%	25.7%	24.8%	16.4%	34.2%	45.4%	23.9%
	Impact	4.9pp**	−0.9pp	0.5pp	4.0pp**	4.9pp***	−0.2pp	2.0pp	2.5pp*
	Differential impact	5.8pp*		−3.5pp		5.1pp*		−0.5pp	

Note. How to read this table: The impact on the earning any postsecondary credential for first-generation students was 11.4 percentage points (pp); and for not first-generation students, it was 12.2 pp. The impact was larger for not first-generation students by 0.8 pp, and this difference is not statistically significant.
$^{*}p \leq .10$; $^{**}p \leq .05$; $^{***}p \leq .01$; $^{****}p \leq .001$.

TABLE 7

Attainment of Postsecondary Credentials, Mutually Exclusive Categories, 6 Years After 12th Grade

Outcome	Adjusted Treatment Mean (N=2,345)	Unadjusted Control Mean (N=1,728)	Impact Estimate (SE)	p-Value
Technical credential only	1.4%	2.1%	−0.7 pp (0.5 pp)	.148
Associate degree only	19.5%	9.2%	10.3 pp (1.5 pp)	<.001
Bachelor's degree only	10.1%	20.6%	−10.5 pp (1.7 pp)	<.001
Both associate and Bachelor's	17.5%	4.5%	13.0 pp (2.0 pp)	<.001

Note. Cluster-robust standard errors at the high school level are presented in parentheses. pp = percentage points.

degrees, early college students earned a statistically significantly higher percentage of credits in advanced courses, with an impact of 7.2 percentage points.

Impact on Majors

Table 9 also shows results for majors. We see descriptively that early college students declared a major earlier in their college career, were less likely to switch majors, and had fewer major-switches, but these differences were not statistically significant at the .05 level. We also do not see any significant impact on the percentage of students who double-majored. It is important to note that double-majoring is uncommon in general (e.g., Yue & Fu, 2017, found 14.3% of their study population was double-majors) and also among this population of students, with only 15.1% of treatment students and 14.9% of comparison students double-majoring at some point in their educational career.

Impact on Time to Degree

Last, Table 9 shows impacts on time to degree for students earning bachelor's degrees from the UNC System, using the quasi-experimental method we use to analyze other outcomes for this sample. We find that early college students earned their degrees about half a year faster than comparison students, 4.3 years after 12th grade, on average, versus 4.7 years after 12th grade for comparison students. This finding is statistically significant and reinforces descriptive findings we have previously reported for students earning bachelor's degrees from any postsecondary institution (Edmunds et al., 2020).

Impact on GPA

As shown in Table 10, treatment students' GPAs were statistically significantly lower in the 1st year in a UNC institution (2.52 versus 2.63) but essentially the same as control students' GPAs through 2 years and cumulative through receipt of a bachelor's degree. This is broadly consistent with our previous findings and suggests that the impact on GPA over the duration of the students' college career was similar even though early college students took higher level courses (and the higher numbers of advanced courses taken could contribute to the lower GPA in the 1st year). As noted previously, there are two competing hypotheses around how we might expect the early college to influence GPA: one around better preparation among early college students that would lead us to expect higher GPAs and the other around students experiencing less time in school, possibly leading us to expect lower GPAs. The results indicate that neither is correct or that they might, in fact, offset each other over time. For example, it is possible that early college students do get less exposure to content and skills but that the content and skills to which they are exposed are higher quality.

Limitations

This study has many strengths including being based on an initial RCT that allows for us to ensure that treatment and control students were similarly motivated. This means that our postsecondary degree attainment findings have high internal validity. There may be concerns about the generalizability of these findings given that we conducted the study in schools that were oversubscribed and were willing to conduct a lottery. Other research conducted using a quasi-experimental design with all early colleges in the state of North Carolina has found similar results (Fuller et al., 2023; Lauen et al., 2017), so we do believe the degree attainment results can be generalized to students who were interested enough to apply to the early college. Additionally, it is rare to have studies that look at the longer-term impacts; here, we can look at outcomes for students 10 years after entrance into the intervention.

TABLE 8

Attainment of Postsecondary Credentials by Subgroup, Mutually Exclusive Categories, 6 Years After 12th Grade

		First Generation		Underrepresented Race/ Ethnicity		Economically Disadvantaged		Early College Hosted at 4-Year Institution	
Outcome		First Gen. (N=1,373)	Not First Gen. (N=2,051)	Underrep. (N=1,430)	Not underrep. (N=2,597)	EDS (N=1,928)	Not EDS (N=1,927)	4-Year Hosted (N=253)	2-Year Hosted (N=3,820)
Technical Credential Only	Control mean	2.8%	1.7%	1.1%	2.7%	1.6%	2.7%	0.5%	2.2%
	Impact	−1.2 pp	0.0 pp	−0.2pp	−1.0pp*	0.3pp	−1.5pp**	0.0pp	−0.7pp
	Differential impact	−1.2pp		0.8pp		1.8pp**		0.7pp	
Associate degree only	Control mean	10.5%	8.2%	5.1%	11.6%	8.2%	10.4%	6.0%	9.4%
	Impact	7.8pp****	13.1pp****	8.1pp****	11.4pp****	8.0pp****	12.4pp****	−1.8pp	11.0pp****
	Differential impact	−5.3pp**		−3.3pp		−4.4pp*		−12.8pp***	
Bachelor's Degree only	Control mean	13.1%	26.6%	22.4%	19.7%	13.7%	27.8%	43.7%	19.2%
	Impact	−8.0pp****	−15.6pp****	−7.8pp****	−12.1pp****	−6.0pp****	−15.5pp****	2.8pp	−11.3pp****
	Differential impact	7.6pp**		4.3pp		9.5pp***		14.1pp**	
Associate and Bachelor's	Control mean	3.6%	5.4%	3.2%	5.1%	2.6%	6.4%	1.9%	4.7%
	Impact	12.9pp****	14.7pp****	8.3pp****	16.0pp****	10.9pp****	15.3pp****	−0.8pp	13.8pp****
	Differential impact	−1.8pp		−7.7pp**		−4.4pp		−14.6pp****	

Note. How to read this table: The impact on the earning only a technical credential for first-generation students was −1.2 percentage points (pp); and for not first-generation students, it was 0.0 pp. The impact was more negative or first-generation college-going students by 1.2 pp, and this difference is not statistically significant.
*$p \leq .10$; **$p \leq .05$; ***$p \leq .01$; ****$p \leq .001$.

TABLE 9

Impact of Early College on Advanced Coursetaking, Majors, and Time to Degree

Outcome	Treatment *N*	Treatment Weighted Mean	Control *N*	Control Mean	Impact Est. (*SE*)	Effect Size	*p*-Value
# credits earned above the 100 level in the first year of enrollment after high school	796	13.1	504	9.8	3.3 (0.65)	.39	<.001
# credits earned above the 200 level in the second year of enrollment after high school	651	12.0	412	7.8	4.2 (0.74)	.46	<.001
Share of credits earned at or above the 300 level, bachelor's degree recipients	493	49.1%	295	41.9%	7.2 pp (1.4 pp)	.46	<.001
# semesters to declare a major, bachelor's degree recipients	493	1.6	295	1.7	−0.2 (0.10)	−.18	.070
% of bachelor's degree recipients who switched majors at least once	493	34.7%	295	41.1%	−6.4 pp (3.9 pp)	−.13	.112
# of major switches, bachelor's degree recipients	493	0.4	295	0.6	−0.1 (0.07)	−.17	.080
% of bachelor's degree recipients who double majored	493	15.1%	295	14.9%	0.2 pp (2.4 pp)	.01	.935
# years since 12th grade to earn bachelor's degree, bachelor's degree recipients	493	4.3	295	4.7	−0.4 (0.08)	−.46	<.001

Note. Samples include all students with outcome data in the relevant year, which is why the sample sizes change across outcomes. Treatment group means are weighted using the propensity score weights described in the main text and effect sizes are calculated as the ratio of the impact estimate to the pooled (weighted) standard deviation. Standard errors are clustered at the high school level. pp = percentage points.

TABLE 10

Impact of Early College on Postsecondary GPA

Outcome	Treatment *N*	Treatment Weighted Mean	Control *N*	Control Mean	Impact Est. (*SE*)	Effect Size	*p*-Value
GPA in 1st year in a 4-year institution	796	2.52	504	2.63	−0.11 (0.04)	−.12	.019
Cumulative GPA through 2nd year in a 4-year institution	651	2.76	412	2.78	−0.02 (0.03)	−.03	.537
Cumulative GPA for bachelor's degree recipients	493	3.00	295	2.97	0.03 (0.02)	.06	.202

Note. Samples include all students with outcome data in the relevant year, which is why the sample sizes change for each outcome. Treatment group means are weighted using the propensity score weights described in the main text and effect sizes are calculated as the ratio of the impact estimate to the pooled (weighted) standard deviation. Standard errors are clustered at the high school level.

It is important to remember, however, that, because of the impact of the intervention on postsecondary enrollment and because of the limitations of the data (where we only had detailed transcript data for students who attended UNC System schools), our treatment and comparison groups for the other postsecondary performance outcomes were not randomly assigned. Given that students were not randomized, we would expect that the two groups might have differed based on a range of contextual and individual factors. We know that a higher proportion of early college students enrolled in UNC System schools; one explanation is that these could have been more marginal students who were induced to attend, a conclusion supported by the descriptive characteristics of the unweighted sample. Including these marginal students in our analyses would likely bias the early college impacts downward. Another explanation is that the early college is encouraging students who might have otherwise gone to a private school to see a public institution as a more viable option; in this scenario, the early college impacts might have been biased upward. However, we weighted our treatment groups for these postsecondary performance analyses to look like the control students who enrolled in the UNC System absent the early college intervention in terms of their observable characteristics. Thus, our results should not necessarily reflect outcomes for those more marginal students or the students who shifted to public from private.

Although we have used best practices to account for observable baseline differences between treatment and comparison students in the quasi-experimental analyses, it is possible that there were unobserved differences, such as student motivation, for which our analyses did not account. These differences may bias our estimates. For instance, if the early college induces less motivated treatment students to attend college, and we do not adequately account for this in our weighting, we may underestimate the impacts of the ECHS on postsecondary success. Alternatively, if the ECHS induces the most motivated students to attend a UNC System school instead of an out-of-state or private school, and our weights do not sufficiently account for this, we may overestimate the impacts of the ECHS. Nevertheless, since our weighting approach was implemented within groups that were originally randomly created, we anticipate that any unmeasured differences in motivation may be less than if we attempted to match treated students with individuals who were not interested enough to apply to an early college.

Additionally, it is important to keep in mind that our weighting approach means that these results apply to early college students who would have gone to a UNC System school even in the absence of the model; thus, while our methods reduce concerns about bias, they yield results that do not reflect the potentially positive effects on students who were induced to pursue further postsecondary education post–high school as a result of attending an early college.

Finally, we want to acknowledge that our analyses of the impact of ECHS housed on 4-year college campuses are very limited as we only had two such institutions in our sample. Studies using statewide data will be able to share better insight on the difference in impacts between the 2-year and 4-year settings.

Conclusions

This study contributes to a growing body of research on the positive impacts of the early college model. Our findings show that early college students are more likely to receive a postsecondary credential with very large impacts on associate degree attainment, consistent with our own and others' previously reported results (Edmunds et al., 2020; Haxton et al., 2016; Lauen et al., 2017; Song & Zeiser, 2021). These new analyses show higher impacts on 4-year degree attainment than our previously published findings with statistically significant positive results for first-generation college-goers, economically disadvantaged students, and students not in historically underrepresented racial or ethnic groups. One of the reasons for the larger impacts could be a maturing of the early college model with the inclusion of two more recent cohorts (that are also the largest two cohorts in our study).

When examining postsecondary attainment by demographic subgroups, we tended to find larger impacts on associate degree completion for students in groups that are not underrepresented in college (e.g., not economically disadvantaged). Perhaps when certain groups of students begin high school, they plan to get a bachelor's degree and not an associate degree; but while attending the early colleges, most of which are located on community college campuses, they decide to obtain an associate degree as well. Future work should examine the influence of earning both degrees on subsequent employment.

We also found that the early college experience gave students a leg up once they finished and enrolled in a four-year university. The substantial number of college credits earned while in the early college allowed students to take a larger proportion of upper-level courses, which suggests that certain parts of their college experience may have been more academically rich, although we did not see any statistically significant impacts on double-majoring.

These benefits may be driven by the components of the early college model. Early college high schools incorporate design principles that support all students in becoming prepared for college and all early college high school students take multiple college courses. Students also receive additional supports including explicit instruction in college readiness skills, such as self-advocacy. Our study shows that all students, including those underrepresented in college, can benefit from this approach in terms of postsecondary education outcomes.

Traditional schools can incorporate early college principles; and in fact, many states have increased the opportunities for high school students to take college classes. Within the early college model, dual enrollment is part of a linked secondary–postsecondary curriculum. Traditional high schools could work with college partners to ensure that dual enrollment courses are part of a coherent pathway, rather than having students take dual enrollment in an ad hoc basis. An aligned curriculum may also prepare the early college students to take more advanced courses earlier in college.

At the beginning of this article, we noted concerns that students might be shortchanged in terms of the richness of their postsecondary experience if they earn their degrees more rapidly. Our analyses confirmed that early college students earned bachelor's degrees more quickly than their peers. At this point, though, we have no evidence to suggest that this negatively impacts their experience in college. Students' GPAs are comparable, which indicates similar levels of academic preparation; and the increased amount of advanced coursetaking suggests that students may be learning more advanced skills. The ultimate test of this will be examining students' performance in the workforce, which will be considered by future research.

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Notes

1. Upon the bankruptcy of North Carolina New Schools in 2015, the North Carolina Department of Public Instruction took over the support of the early college effort in North Carolina. The Department has revised these design principles; in this article, however, we discuss the design principles as they were conceptualized during the time period that our study's students were enrolled in high school.
2. NSC data do not cover all short-term certificates and credentials. For instance, some technical credentials and industry-recognized credentials are not covered by the data.
3. Students missing baseline data for economic disadvantage, race or ethnicity, and eighth-grade reading exams were excluded from the analyses; and therefore, the sample on which baseline equivalence was assessed and the analysis sample were equivalent for these measures.

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