Can High School Transition Courses Help Students Avoid College Remediation? Estimating the Impact of a Transition Program in a Large Urban District

Madeline Joy Trimble
Lara Pheatt
Tatev Papikyan
Elisabeth Barnett

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Address correspondence to:

Elisabeth A. Barnett
Senior Research Associate, Community College Research Center
Teachers College, Columbia University
525 W. 120th St., Box 174
New York, NY 10027
212-678-3091
Email: barnett@tc.edu

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Abstract

Graduating from high school does not always ensure successful transition into postsecondary education or other career training. While college participation rates are at a historic high, too many students who graduate from high school are underprepared for college. Schools across the country are working to help improve students' college readiness by implementing transition courses developed jointly by secondary and postsecondary faculty for students at risk of being placed into remedial math or English coursework.

This study examines the effectiveness of math and English transition courses with added supports through the At Home in College program in New York City, which was developed by the City University of New York. Our study asks: What is the impact of the availability of the transition course program on students' attainment of college readiness benchmarks upon initial college enrollment and on students' likelihood of passing a first college-level (gatekeeper) course in the related subject in the first year of college? Taking advantage of staggered program implementation, we employ a difference-in-differences (DID) methodology to compare the difference in student outcomes between cohorts of students in schools that continuously implemented the transition program during a given timeframe to the difference in outcomes between cohorts that had not yet implemented the program. Our findings in relation to English suggest a small negative impact (3 percentage points) on college readiness and no impact on passing an English gatekeeper course within the first-year of college entry. In math, we find no impact on college readiness in math and a small positive and significant effect (1 percentage point) on passing a math gatekeeper course within one year of college entry. In both subjects, we find a small, positive impact (1 credit) on the number of college course credits earned in the first year. However, these results are somewhat sensitive to alternate sample specifications.

Taken together, the findings suggest that offering the program is likely neutral to mildly beneficial and at least not harmful to high school seniors. Yet because the counterfactual circumstance typically includes a college-preparatory course of some kind that is displaced in favor of the treatment, it is important for policymakers and educators implementing transition courses to carefully consider the unintended consequences of removing students from alternative courses. If the alternative courses are already rigorous, well-taught, and packed with content that is useful for college success, the transformative impact of a transition course may be limited.

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1. Introduction

To be competitive in the 21st century global economy, the United States needs a highly skilled workforce and an informed citizenry. Accordingly, this requires high schools to graduate students ready for college or career training programs. However, students face significant difficulties meeting college requirements for entry into college-level courses. Large numbers of high school graduates are required to repeat basic academic courses, typically in math and English, in order to be permitted to enter college-level courses. This can slow down or derail their completion of a degree or credential (Root, 2013). The lack of student readiness for college costs the nation $3.7 billion a year according to one estimate. Of that total, $1.4 billion is spent providing remediation, while almost $2.3 billion is lost due to the diminished earning potential of students who drop out of college without earning a degree (Alliance for Excellent Education, 2006). In addition, employers express concern about students who do not have adequate skills in reading, writing, math, and problem-solving to be effective on the job (Symonds, Schwartz, & Ferguson, 2011).

An emergent body of research suggests that in order to reduce the numbers of students who arrive at college underprepared, high schools and policymakers should focus more on preparing students for college during their high school years, instead of looking to colleges to fix the problem (Conley, 2007; Venezia, Kirst, & Antonio, 2003). Transition curricula, especially transition courses, have the potential to better prepare students for college while they are still in high school. Transition courses are interventions designed for high school seniors who fail to meet college readiness benchmarks according to their 11th grade test scores on early college readiness assessments (Barnett, Fay, Bork, & Trimble, 2013). There is growing interest in transition courses as a possible antidote to high rates of remediation, and they are now found in almost half of all states (Barnett, Fay, Trimble, & Pheatt, 2013).

The current research study examines the impact of one transition course model, the At Home in College program, offered to selected high school students in New York City by the City University of New York (CUNY).

1.1 Background on Transition Courses

Some states and high schools are implementing transition courses to help students become college-ready by the end of grade 12. The intervention is designed to help students achieve college readiness by the time they graduate high school in order to avoid costly remediation and to prepare them for success in college. A number of states have implemented various versions of a transition course program with mixed results.

In California, the Expository Reading and Writing Course (ERWC), developed under the auspices of California State University, is offered in high schools throughout the state. Research findings show that students who enrolled in the ERWC scored higher on the English Placement Test (EPT), and the difference was statistically significant at the 1 percent level (Fong, Finkelstein, Jaeger, Diaz, & Broek, 2015). In West Virginia, the Transition Math for Seniors math courses offered from 2011 to 2013 did not appear to have improved academic outcomes for underprepared students. The course displaced students from taking other senior year mathematics courses, and students who took Transition Math for Seniors were found to be less likely to pass initial college-level math courses than if they had not taken the transition math course at all (Pheatt, Trimble, & Barnett, 2016).

The At Home in College (AHC) program, the focus of this paper, has several unique features designed to prepare high school students for success in college in addition to math and English coursework. The program offers a counselor-led unit on the transition to college, scholarships to cover the CUNY application fee, assistance with completing the Free Application for Federal Student Aid (FAFSA), and advisement during the summer after high school graduation. These added features were developed based on research that indicated that college enrollment and success is based on more than academic factors alone. For example, a study by Bettinger, Long, Oreopoulos, and Sanbonmatsu (2009) suggests that receipt of assistance in completing FAFSA paperwork results in a higher likelihood of enrolling in college and a greater amount of financial aid awarded. Carrell and Sacerdote (2013) found that giving high school students college counseling and application fee waivers increased college matriculation, particularly among students attending disadvantaged high schools. Results of a study by Hoxby and Turner (2013) indicated that sending high-achieving, low-income students application fee waivers and information about colleges and optimal application strategies induced them to attend more-selective colleges.

1.2 Background on the At Home in College Program

In the spring of 2008, the Robin Hood Foundation, a nonprofit organization dedicated to fighting poverty in New York City, asked CUNY to develop a project to improve student access to and success in community colleges. In response to this request, CUNY's senior university dean for academic affairs convened pre-college program administrators (mainly from dual enrollment programs) to examine the available data on student enrollment and persistence and to discuss initiatives that would address the main barriers that students encounter in the transition to community college. In fall 2008, this work resulted in the proposal for the AHC program, including both its transition courses and the supports noted just above in the previous subsection (Venezia & Voloch, 2012).

In the state of New York, students take Regents exams, which serve as high school exit tests. Currently, students must pass with a score of at least 65 out of 100 to graduate from high school with a Regents diploma. The state has also established benchmark scores that indicate college readiness on the English and math Regents exams. To be considered college-ready based on Regents scores, a student must have a score of at least 75 on the English exam and a score of at least 80 on any Math Regents exam (including Integrated Algebra, Geometry, Algebra II, or Trigonometry). Students must also complete Algebra II and Trigonometry or a higher level math course to be considered college-ready in math. In participating New York City schools, transition courses are offered to students who are on track to graduate high school but not likely to attain college readiness without additional support. The state of New York is now in the process of developing similar courses for other regions of the state.

During the 2012–13 school year, AHC transition courses were offered in 62 (out of about 400) public high schools, located in all five boroughs of New York City, to 1,903 participants. Fifty-one schools offered both a math and English transition course, while nine schools offered only the English and two schools only the math course. The AHC English course was originally implemented in spring 2009 as a semester-long intervention for 12th grade students but evolved into a yearlong course by the 2009–10 academic year. The course aims to expose high school students to nonfiction texts in collegiate fields of study. Students study topics in psychology during the first semester and in sociology in the second semester. The AHC math course was first offered during the 2010–11 academic year as a full-year course. Program staff and faculty in CUNY's College Now dual enrollment program developed the English course, and staff developers in CUNY's Adult Literacy/GED Program developed the original math course.

In addition to the transition courses, the AHC program offers participants a number of supports throughout their senior year and into their first year of college. These additional supports can include "college knowledge" instruction, college visits for high school seniors, fee waivers on the CUNY application fee, assistance in completing the FAFSA, academic advisement, and internship opportunities.

1.3 Data and Measures

The data used in carrying out this study come from CUNY in partnership with the New York City Department of Education (NYCDOE); we received both high school and college outcome data for each senior enrolled in a New York City high school during the academic years 2007–2008 through 2012–2013.

Our two primary outcome variables used to measure the effectiveness of the AHC program are (1) college readiness upon college entry as determined by any one of the measures accepted by the CUNY college system (e.g., test scores on Regents, CUNY Assessment Tests [CAT], SAT, and ACT) and (2) passing a gatekeeper (first college-level) course in the same subject area within one year of graduating high school. Both of these variables are binary and coded "0" for students who do not attend a CUNY college within one year. Covariates that we use to control for student-level characteristics include student demographic characteristics (race/ethnicity, language spoken at home, free and reduced lunch, grade point average [GPA] in 9th through 11th grade), the cohort year in which the student was a high school senior, and test scores (including both 8th grade math and English scores, and math and English Regents scores through the 11th grade). Covariates with missing values are recoded as "0" for use in modeling, complemented by an additional binary "missing" indicator in order to include observations with missing values in the sample without introducing bias.

We also examine four "secondary" outcomes, which are not used to determine the effectiveness of the intervention but rather to provide greater context about the implementation of the program. These include a binary indicator for attempting a college-level gatekeeper math course, a binary indicator for enrollment in a CUNY college within one year, developmental (remedial) education earned credit accumulation, and college-level earned credit accumulation all within one year.

We selected the two primary outcome measures that we felt best reflected the overall success of the course, along with the four secondary outcome measures, prior to beginning analysis. In doing so, we aimed to avoid bias that might stem from any subconscious researcher impulse to alter the analyses performed or the results highlighted to achieve a desired narrative.

1.4 Descriptive Statistics

Broadly speaking, the student population served by AHC is comprised mostly of Black and Hispanic students with high proportions receiving free or reduced price lunch. As shown in Table 1, students who attended high schools that offered AHC in their senior year were less likely to be White or Asian, and more likely to be Black or Hispanic; more likely to speak English or Spanish in the home and not another language; and slightly more likely to receive free or reduced lunch. They also exhibited lower GPAs in their freshman through junior years of high school. However, students at the two groups of schools showed a similar likelihood of attending a CUNY college in the year following high school graduation.

Within schools that offered the AHC program, not all seniors participated. Overall, 23 percent of seniors participated in AHC English and 22 percent participated in AHC math at schools that offered AHC in those subjects during their senior year. Because the target population for the intervention was students who were on track to graduate without being college-ready, Regents exam scores were used to guide placement. The target population therefore included students whose Regents exam scores were above 65 (the minimum to graduate with a Regents diploma) and below the college-readiness benchmarks of 75 in English and 80 in mathematics.

It is also worth noting that the students who formally participated in the AHC program (thus receiving a waiver to take the CUNY placement test and other additional program benefits) did not overlap perfectly with the students who enrolled in the transition course associated with AHC—we discuss this issue at the end of this section.

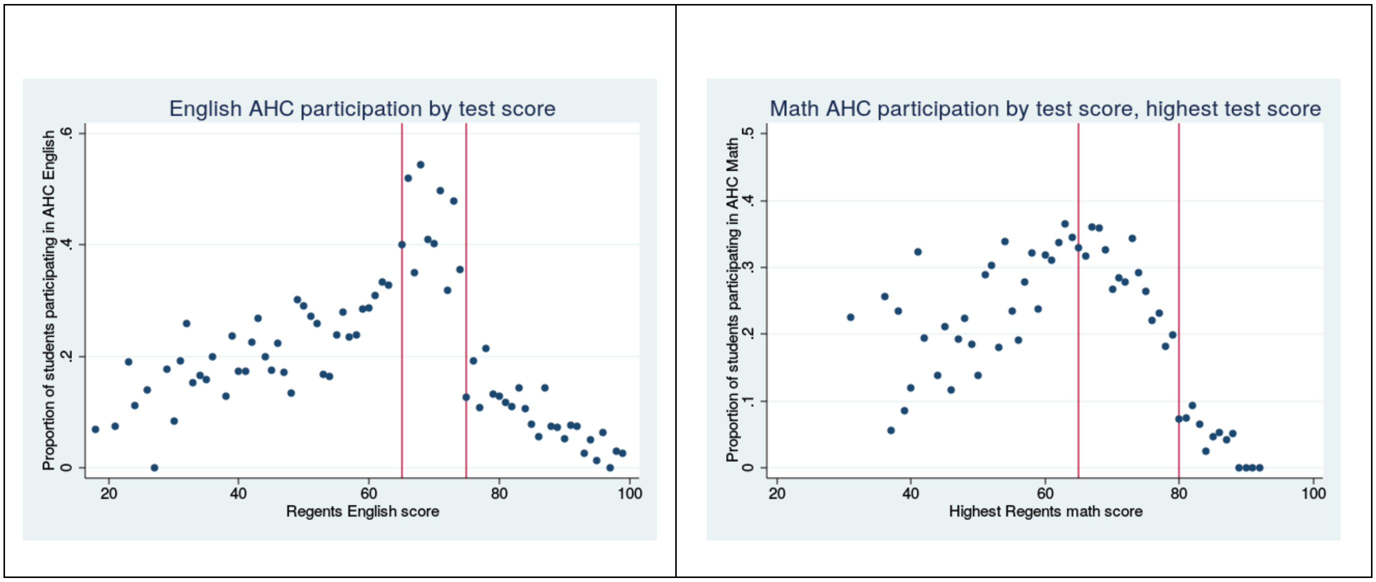
Table 1
Student Characteristics at Non-AHC Schools, at AHC Schools, and Among AHC Participants

Student Characteristic	High School Never Offered AHC	High School Offered AHC	**Students Who Formally Participated in AHC**
Race/ethnicity			
White, non-Hispanic	16%	5%	3%
Hispanic	34%	41%	47%
Asian	19%	9%	4%
Black	30%	42%	42%
Native American	0%	0%	0%
Multiracial or other	2%	2%	2%
Language spoken at home			
English	52%	60%	61%
Spanish	26%	30%	33%
other	22%	11%	7%
Female	52%	54%	52%
Received free or reduced lunch	93%	97%	96%
GPA (9**th**–11**th** grade)	2.17	2.02	1.93
Enroll in CUNY within one year	39%	40%	45%
N (students)	292,491	40,212	4,395
N (schools)	480	69	69

As Figure 1 shows, students in the target population test score range were much more likely to participate in the AHC program, particularly in English.[1] In Figure 1, each point represents the proportion of students at a given test score who participated in AHC at schools that offered AHC to seniors in that subject. In English, the x-axis reflects information on the English Regents exam generally taken in the 11th grade. In mathematics, the Regents exam score includes a student's highest score available from one of several Regents exams: Algebra 2/Trigonometry, Geometry, Integrated Algebra, Math A, and Math B.[2] These math Regents exams are often taken in the 9th or 10th grade. In Figure 1, red lines indicate boundaries around the targeted range of test scores.

[1] While this figure might seem to indicate the potential for a regression discontinuity design, as was our original intention when planning this study, several key assumptions are violated that prevented us from doing so. First, there is evidence that students or their teachers manipulated their test scores around the cutoff points. Second, the same cutoff points are used for other purposes that will influence our outcomes of interest through separate but related mechanisms (such as diploma receipt and remediation exemption). We instead employ a difference-in-differences design, which we will explain in more detail later in the next section.
[2] The exact mix of Math Regents exams offered varied among the academic years under study.

Figure 1
AHC Participation by Regents Test Score



We find that neither eligibility for the AHC program nor participation in it is necessarily equivalent to actually taking the transition course. Qualitative research suggests that high schools thought strategically about which students to allow to participate in the program given limits on the number of waivers available, and that these decisions were also affected by course scheduling necessities (Pheatt et al., 2016). Unfortunately, our data do not permit us to identify AHC transition courses taken in the transcript data at all schools. However, we compare AHC program participation to transcript course participation at the schools for which we have both data points available; both data points are available for 49 percent of AHC math participants and 38 percent of AHC English participants. At these schools, we find that most students who were formally designated as AHC program participants also enrolled in one or more transition courses (as shown in Table 2), and that most students who enrolled in the transition courses were formally designated AHC program participants (not shown in Table 2). However, as we will describe in the next section, the distinction between these two different measures of receipt of the AHC treatment is not ultimately consequential for our impact estimates. The methodology we use will estimate the impact of *availability* of the program and transition course to students rather than the impact of participation itself.

Table 2
AHC Program Participation Versus Transition Course Enrollment

Participated in AHC Program?	Did Not Enroll in Transition Course	Enrolled in Transition Course
AHC math (No)	3,250 (89%)	390 (11%)
AHC math (Yes)	328 (26%)	911 (74%)
AHC English (No)	4,055 (92%)	332 (8%)
AHC English (Yes)	334 (26%)	937 (74%)

2. Methods

This study is intended to ascertain whether the availability of AHC math and English programs (1) improved students' college readiness and (2) improved students' likelihood of passing a gatekeeper course within the first year of enrolling in college. To estimate the impact of New York City's math and English AHC programs on these early college outcomes, we employ a difference-in-differences (DID) strategy.

In the simplest form of the DID model, a two-group and two-period model, an outcome of interest is observed across two groups and two time periods. In the first time period, subjects in neither group receive the treatment; in the second time period, only one of the two groups is exposed to the treatment (i.e., the treatment group) while the other group never receives the treatment (i.e., the control group). The average gain over time for the control group is then subtracted from the gain over time in the treatment group. The result is a double differencing, which removes any biases in the second time period comparisons between the control and treatment groups that result from permanent differences between the groups; it also controls for other biases which may result from trends over time that affect both the treatment group and the control group (Imbens & Wooldridge, 2008, p. 65).

In our study, the treatment group consists of students who attend a school that offers the AHC transition program in a given year and who fall within the target population based on Regents exam scores; the control group consists of students who attend schools that do not offer the AHC program in either math or English in that year but who also fall within that target population. Unlike the simple model described above, we have multiple groups (that is, schools) and multiple time periods (in which the "pre-"

and “post-” period varies for each school). It is therefore more appropriate to think of our DID model as one that estimates the effect of attending a school that offers the AHC program in one’s senior year, after controlling for fixed school and cohort effects, for a student in the program’s target population based on test scores.

In the idealized scenario above, the estimating equation for a model with only a single pre- and post-time period as well as only one treatment group and one control group would be as follows.

$$Y_i = \beta_0 + \beta_1(POST) + \beta_2(TREAT) + \beta_3(POST * TREAT) + \boldsymbol{\tau}'\boldsymbol{X}_i + \varepsilon_i$$

where Y_i is the outcome measure, $POST$ is a binary indicator for being in the later cohort; $TREAT$ is a binary indicator for being in an early-implementing high school; and the interaction term $POST * TREAT$ is therefore “1” when a high school offers AHC English or AHC math in a given year and “0” otherwise. The coefficient on this interaction term is also our DID estimate. The model also includes $\boldsymbol{X}_i$, which is a vector of student covariates, and an error term ε_i.

Our study includes multiple time periods and multiple groups such that some adjustments to this model are necessary. As a reminder, our sample includes senior cohorts from the academic years 2007–08 up until 2012–13, for a total of six time periods; within each year, we are also looking at multiple high schools—i.e., multiple groups—which began implementing the AHC program at different times (if at all). As suggested by Imbens and Wooldridge (2008), when a model incorporates multiple time periods and groups, researchers should use separate parameters for each group and time period. The impact estimate will then be represented by a single indicator variable for whether the treatment status for a group is “on” or “off” at a given time rather than a series of interaction terms. Our estimating equation is therefore:

$$Y_i = \beta_0 + \beta_1(COHORT\_FE) + \beta_2(SCHOOL\_FE) + \beta_3(HS\_CURRENTLY\_OFFERS\_AHC) + \beta_3(POST\_POST) + \boldsymbol{\tau}'\boldsymbol{X}_i + \varepsilon_i$$

where Y_i is the outcome measure, $COHORT\_FE$ are cohort fixed effects; $SCHOOL\_FE$ are high school fixed effects; $HS\_CURRENTLY\_OFFERS\_AHC$ is an indicator variable for whether a high school offers AHC English or AHC math (depending on the subject being estimated) in a given year. The coefficient on $HS\_CURRENTLY\_OFFERS\_AHC$ reflects our DID estimate.

An additional concern arises because, in the case of AHC, schools may choose to stop implementing the program after initially offering it. The time periods when a high school is NOT offering AHC—but had previously offered it in the past—may not serve as an appropriate control for the time periods when a high school is offering AHC.[3] Following Autor, Donohue, and Schwab (2006), we therefore include a variable "$POST\_POST$" that receives a "1" in these high school and cohort combinations to absorb their impact without dropping these observations. We also include, $\boldsymbol{\tau}'\boldsymbol{X}_i$, which is a vector of student covariates including gender, race/ethnicity, whether the student receives free or reduced lunch, GPA for grades 9–11, and performance on prior math and reading standardized exams. Robust standard errors are clustered at the high school level.

[3] Ideally, for the sake of simplicity of our model, the AHC program would have been implemented continuously across all of the participating schools; however, not all participating high schools actually continued to implement the course in every year following the first year that each school began implementing. That is, of the 68 schools that offered AHC English, only 46 schools continued to implement AHC English in every year recorded in our data after their first year offering the program. Of the 56 high schools that offered the math AHC program, 24 schools continued to offer the program continuously after the first year. Limiting our sample to continuous implementers would affect our generalizability and external validity; we therefore include them but control for the time periods at those schools that take place after initial implementation but when AHC is not offered.

3. Results

In this section, we first report the estimated impacts of the AHC English and math programs using our preferred DID specification. We next report the results of assumption checks as well as estimated impacts under alternative model and sample specifications. Finally, we descriptively summarize treatment intensity and outcome-related information for both the participant and non-participant populations in order to contextualize our main findings.

3.1 Preferred DID Specification

Taken together, our estimates of the impact of AHC (Tables 3 and 4 for AHC English and math, respectively) suggest a mixed impact of the program. In English, there exists a small but statistically significant negative impact (3 percentage points) on college readiness upon college entry but no statistically significant impact on passing a gatekeeper English course at CUNY within one year following high school graduation. In math, there is a small but statistically significant positive impact (1 percentage point) on passing a gatekeeper math course at CUNY within one year, but no statistically significant impact on college readiness upon entry.

Table 3
Impact of AHC English Using Preferred Model and Sample Specification

	(1)	(2)	(3)	(4)	(5)	(6)
	Passed Gatekeeper English Within One Year	College-Ready Upon Entry (Reading and Writing)	Enrolled in College Within One Year	Attempted Gatekeeper English Within One Year	College-Level Credits Earned Within One Year	Developmental Credits Earned Within One Year
AHC English	0.02 [0.01]	-0.03* [0.01]	0.02 [0.01]	0.02 [0.01]	1.35* [0.63]	0.30 [0.78]
N	61,500	61,500	61,500	61,500	61,500	61,500
R-squared	0.09	0.08	0.09	0.09	0.15	0.05

Note. Robust standard errors in brackets.

**$p < 0.01$, *$p < 0.05$

Table 4
Impact of AHC Math Using Preferred Model and Sample Specification

	(1)	(2)	(3)	(4)	(5)	(6)
	Passed Gatekeeper Math Within One Year	College-Ready Upon Entry (Math)	Enrolled in College Within One Year	Attempted Gatekeeper Math Within One Year	College-Level Credits Earned Within One Year	Developmental Credits Earned Within One Year
AHC Math	0.01*	0.02	0.02	0.01	1.23*	0.90
	[0.01]	[0.01]	[0.01]	[0.01]	[0.54]	[0.61]
N	109,547	109,547	109,547	109,547	109,547	109,547
R-squared	0.06	0.09	0.08	0.06	0.11	0.05

Note. Robust standard errors in brackets.

$^{**}p < 0.01$, $^{*}p < 0.05$

3.2 Assumption Checks and Alternative Specifications

As discussed in the methodology section, there are some decisions we made with regard to both how to model the impact of exposure to the AHC program and how to specify the analysis sample. In this section, we discuss these more fully and provide estimates of the impact of AHC under alternative model and sample specifications.

First, in Tables 5 and 6, we display a stepwise regression table for English and math respectively that summarizes the impact estimate as additional covariates are added to the model. In both Tables 5 and 6, columns 1–4 successively add covariates to the model for the outcome of passing a gatekeeper course, while columns 5–8 successively add covariates to the model for the outcome of college readiness upon college entry. Columns 1 and 5 represent the simplest and most straightforward DID model given our preferred sample: we estimate the impact of AHC in a given subject being offered at a high school when the student is a senior, after controlling for high school and cohort fixed effects but no other covariates. With this simplest model, no impact coefficients appear statistically significant. Columns 2 and 6 add in an indicator that marks being a senior in an ex-AHC school, that is, at a high school that offered AHC for at least some previous cohorts but not the current cohort. Without this indicator, students in ex-AHC schools serve as controls for students in current-AHC schools, even though we might suspect this could introduce bias. The inclusion of this indicator reduces our estimate of the impact of AHC English on college readiness, leading to a negative and statistically significant result. Columns 3 and 7 add student demographic covariates, and columns 4 and 8 add student academic covariates. These covariates do not result in major changes to the estimates of the impact but increase the precision enough that the positive impact of AHC math on passing a gatekeeper math course registers as statistically significant ($p < 0.05$). Columns 4 and 8 display our preferred model.

Table 5
Stepwise Regression Table for Impact of AHC English on Primary Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Passed Gate-keeper English Within One Year	Passed Gate-keeper English Within One Year	Passed Gate-keeper English Within One Year	Passed Gate-keeper English Within One Year	College-Ready Upon Entry (Reading and Writing)	College-Ready Upon Entry (Reading and Writing)	College-Ready Upon Entry (Reading and Writing))	College-Ready Upon Entry (Reading and Writing)
AHC English	0.01 [0.01]	0.01 [0.01]	0.01 [0.01]	0.02 [0.01]	-0.02 [0.01]	-0.04* [0.01]	-0.04* [0.01]	-0.03* [0.01]
Cohort fixed effects	X	X	X	X	X	X	X	X
HS fixed effects	X	X	X	X	X	X	X	X
Post-post implementation indicator		X	X	X		X	X	X
Student demographic characteristics			X	X			X	X
Student academic characteristics				X				X
Observations	61,500	61,500	61,500	61,500	61,500	61,500	61,500	61,500
R-squared	0.04	0.04	0.05	0.09	0.04	0.04	0.05	0.08

Note. Robust standard errors in brackets. The post-post implementation indicator refers to a binary indicator that is "1" for students attending schools where AHC is not offered to their cohort but where the school had previously offered AHC in the past, and "0" otherwise. Demographic characteristics include race/ethnicity, gender, free-and-reduced lunch status, and whether a student's language spoken at home is English, Spanish, or other. Academic characteristics include 8th grade test scores in English Language Arts and mathematics, Regents test scores in math and English if taken in the junior year or earlier, and students' estimated GPA from 9th through 11th grades.

**$p < 0.01$, *$p < 0.05$

Table 6
Stepwise Regression Table for Impact of AHC Math on Primary Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Passed Gate-keeper Math Within One Year	Passed Gate-keeper Math Within One Year	Passed Gate-keeper Math Within One Year	Passed Gate-keeper Math Within One Year	College-Ready Upon Entry (Math)	College-Ready Upon Entry (Math)	College-Ready Upon Entry (Math)	College-Ready Upon Entry (Math)
AHC Math	0.00 [0.01]	0.01 [0.01]	0.01* [0.01]	0.01* [0.01]	0.01 [0.01]	0.02 [0.01]	0.02 [0.01]	0.02 [0.01]
Cohort fixed effects	X	X	X	X	X	X	X	X
HS fixed effects	X	X	X	X	X	X	X	X
Post-post implementation indicator		X	X	X		X	X	X
Student demographic characteristics			X	X			X	X
Student academic characteristics				X				X
Observations	109,547	109,547	109,547	109,547	109,547	109,547	109,547	109,547
R-squared	0.02	0.02	0.03	0.06	0.04	0.04	0.05	0.09

Note. Robust standard errors in brackets. The post-post implementation indicator refers to a binary indicator that is "1" for students attending schools where AHC is not offered to their cohort but where the school had previously offered AHC in the past, and "0" otherwise. Demographic characteristics include race/ethnicity, gender, free-and-reduced lunch status, and whether a student's language spoken at home is English, Spanish, or other. Academic characteristics include 8th grade test scores in English Language Arts and mathematics, Regents test scores in math and English if taken in the junior year or earlier, and students' estimated GPA from 9th through 11th grades.

** $p < 0.01$, * $p < 0.05$

However, some of the most significant methodological questions are involved the sample specification rather than the model specification. As discussed in the methodology section, our preferred sample includes seniors at all New York City (NYC) high schools (except special transfer high schools) who scored within the target range on the Regents exam. In Tables 7 and 8, we report the results from our preferred model under four different alternative sample specifications for our primary outcomes for AHC English and AHC math respectively. Columns 1–4 estimate the impact of AHC on passing a gatekeeper course, while columns 5–8 estimate the impact of AHC on college readiness at college entry. The first column (that is, columns 1 and 5) uses our preferred sample specification as reported above. However, the second column (columns 2 and 6) restricts our sample to only students at high schools that offer AHC at some point, under the theory that high schools that never offer AHC may not serve as appropriate controls for high schools that choose to offer AHC at some point. Columns 3 and 7 further restrict the sample to students at high schools that offer AHC continuously—that is, their high schools never first offer AHC then cease to offer it under the cohorts examined for this study. Columns 4 and 8 instead make our sample more inclusive relative to our preferred sample, including all seniors at NYC high schools even if their Regents scores do not place them into the program's target population.

The most significant implication from Tables 7 and 8 is that our model is somewhat sensitive to alternative sample specifications. The estimates of the impact of AHC change under these alternative specifications, even in excess of the standard error. For example, if we consider the most restrictive sample of continuous implementers only, it would appear that there is a statistically significant positive impact of AHC English on passing a gatekeeper course, but no other statistically significant impacts; however, the coefficient on AHC math is negative (unlike the positive and statistically significant impact under our preferred sample). On the other hand, if we consider the most inclusive sample of all seniors (regardless of Regents scores), AHC math appears to have statistically significant positive impacts on both primary outcomes, while AHC English appears to have no statistically significant impacts.

Table 7
The Impact of AHC English Under Alternative Sample Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Passed Gatekeeper English Within One Year				College-Ready (Reading and Writing)			
	Preferred Sample	Ever-Imple-menters Only	Contin-uous-Imple-menters Only	All Seniors (Not Just Target Popula-tion)	Preferred Sample	Ever-Imple-menters Only	Contin-uous-Imple-menters Only	All Seniors (Not Just Target Popula-tion)
AHC English	0.02 [0.01]	0.02 [0.01]	0.04* [0.02]	0.01 [0.01]	-0.03* [0.01]	-0.03 [0.02]	-0.02 [0.02]	-0.01 [0.01]
N	63,311	8,925	5,533	332,703	63,311	8,925	5,533	332,703
R-squared	0.09	0.09	0.09	0.11	0.08	0.08	0.08	0.11

Note. Robust standard errors in brackets.
**$p < 0.01$, *$p < 0.05$

Table 8
The Impact of AHC Math Under Alternative Sample Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Passed Gatekeeper Math Within One Year				College-Ready in Math			
	Preferred Sample	Ever-Imple-menters Only	Contin-uous-Imple-menters Only	All Seniors (Not Just Target Popula-tion)	Preferred Sample	Ever-Imple-menters Only	Contin-uous-Imple-menters Only	All Seniors (Not Just Target Popula-tion)
AHC Math	0.01*	-0.00	-0.02	0.01**	0.02	0.01	0.04	0.02*
	[0.01]	[0.01]	[0.02]	[0.00]	[0.01]	[0.01]	[0.03]	[0.01]
N	111,843	11,696	5,054	332,703	111,843	11,696	5,054	332,703
R-squared	0.06	0.06	0.07	0.05	0.09	0.09	0.10	0.12

Note. Robust standard errors in brackets.
$^{**}p < 0.01$, $^{*}p < 0.05$

This sensitivity to alternative sample specifications raises concern about the validity of our model. The validity of this DID methodology rests on some key assumptions. First, we assume that schools would have followed a similar trend in their outcome trajectory over time had they not implemented the AHC program (or had they implemented the program at the exact same time). Embedded in that assumption, no time-varying characteristics (other than the treatment) should have changed differentially across schools that could also affect the outcome measures; that is, any difference in outcome measure changes across schools should be attributable to the adoption of the AHC program. Unfortunately, we know that other programs and innovations were likely co-occurring at some schools during the time period examined, and we do not have data on which programs were offered and when they were offered. However, to lend credibility to our impact estimates, we can at least conduct some falsification checks.

In Table 9, we report on a set of falsification checks wherein we treat observable pre-treatment student characteristics as outcome measures: whether a student is female, GPA in 9th–11th grade, and whether a student is Black (reported statically). We find a statistically significant result for only one "outcome": the impact of AHC math on whether a student is Black. However, the presence of any statistically significant results is slightly concerning as an impact is broadly implausible. Because we control for race/ethnicity in the other models, this is not a direct threat to the validity of our methodology. It suggests, however, that we should interpret results with some caution.

Table 9
Impact of AHC English on Covariates That Are Implausible as Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Female (English)	GPA in 9th–11th Grade (English)	Black (English)	Female (Math)	GPA in 9th-11th Grade (Math)	Black (Math)
AHC English	0.01 [0.01]	-0.02 [0.03]	0.01 [0.01]			
AHC Math				-0.01 [0.01]	-0.03 [0.03]	0.02* [0.01]
Observations	61,500	60,924	61,438	109,547	108,408	109,457
R-squared	0.11	0.37	0.48	0.12	0.42	0.46

Robust standard errors in brackets.

**$p < 0.01$, *$p < 0.05$

3.3 Understanding the Treatment and Its Impact

Overall, the impact estimates suggest a roughly neutral impact of the program: exposure to the At Home in College program seems to neither particularly help nor particularly harm high school seniors. In this subsection, we offer descriptive statistics that may better explain and interpret these findings. First, we explore the counterfactual. The treatment examined using our DID method is exposure to the AHC program, not necessarily participation in the program. In other words, the DID analysis estimates the impact of attending a high school that offers the AHC program in one's senior year for every student in the Regents target population, regardless of whether each student is officially designated as a program participant or enrolls in the associated transition course. We therefore first ask: To what extent do exposed students in the target population actually enroll in an AHC course? Furthermore, if those students had not been exposed to AHC, what subject courses would they have taken instead? Second, among those students who actually did enroll in an AHC course, we examine their performance on a college readiness test in order to elucidate how much we could realistically expect this course to lead to improvements on our chosen outcome measures.

Table 10 shows the range of courses students in the target range (based on the Regents exam score) enrolled in during their senior year of high school when a high school either did or did not offer AHC math. These data are from schools that offered the

AHC program at some point,[4] and represent the difference between course-taking patterns for target population students at these schools in the years that each high school offered AHC versus those years that each did not. Because students cannot choose whether AHC Transition Math is offered at their school, the increase in participation in AHC Transition math—and the corresponding decrease in participation in courses such as Algebra II/Trigonometry, Precalculus, and Geometry—is plausibly exogenous. We therefore view the courses in the "not offered" column as the alternative courses to the AHC program courses. The difference between the two columns helps illustrate the counterfactual. The shift in course-taking patterns indeed appears to be induced by the availability of AHC, and so in our DID model the "treatment" reflects the increased probability of taking AHC mathematics as opposed to other courses or no math at all.

As Table 10 shows, about one quarter of students in the target range took the AHC course when it was offered at their high school. This highlights the fact that placement into the course was not strict, and that students who were eligible to take the course often did not do so. The largest shift in enrollment occurred from Algebra II/Trigonometry to AHC Transition Math, but upon introduction of AHC Transition Math, enrollment also declined in Precalculus, Geometry, and Statistics. This suggests that when AHC Transition Math became available, many students who would have otherwise taken Algebra II/Trigonometry and other courses ended up taking AHC Transition Math instead. It is possible, but not testable using our data, that these courses could be more rigorous and more likely to prepare students for college-level math than AHC Transition Math or that it could improve other student outcomes.

In both columns of Table 10, we see that large percentages of students took no math. Four years of required math is common in many states; however, New York State does not require this of its students, which may partially explain why a substantial proportion of students do not take math. Still, fewer students take no math when AHC Transition Math is offered, which suggests that the course positively influences some students to take math when they otherwise would not.

[4] Specifically, only high schools with transcript data that allowed us to identify transition courses are included in these two tables; see Section 1.4 for more detail.

Table 11 illustrates that about 30 percent of students in the target range enroll in AHC Transition English when it is available but that, like math, merely belonging to the target population where the AHC program is offered does not ensure enrollment in the Transition English course. We find that the largest shift in enrollment happens in the category of Literature and General English (which includes most standard, non-honors fourth year English courses). Specifically, 63 percent of the target range population took "regular" English in years when the AHC program was not offered, but we see a drop to 41 percent in the years in which AHC is offered. As with math, we cannot directly assess the level of rigor and college preparation in each of these two courses.

Table 10
Senior Year Math Course-taking Patterns, by Availability of AHC Math, Among Target Population

	Not Offered	Offered
AHC Transition Math	1.06%	23.50%
Calculus	3.24%	2.90%
Precalculus	12.98%	10.70%
Geometry	14.35%	7.76%
Algebra 2/Trigonometry	35.21%	26.32%
Algebra 1	0.84%	0.54%
Statistics	2.78%	1.74%
Other math	5.84%	8.23%
No math	23.71%	18.31%

Table 11
Senior Year English Course-taking Patterns, by Availability of AHC English, Among Target Population

	Not Offered	Offered
AHC Transition English	0.11%	30.37%
Honors English	9.79%	10.20%
Writing and Composition	12.47%	8.19%
Literature and General English	62.65%	40.67%
ESL English	0.11%	0.22%
Other English	1.12%	0.92%
No English	13.75%	9.44%

In both subjects, however, it is notable that the presence of a transition mathematics or transition English course is diverting students from enrolling in other mathematics and English courses more often than it is diverting students from enrolling in no math or English at all. Therefore, in interpreting impact estimates, we need to take care to emphasize that these results do not indicate the impact of a transition course in isolation; they reflect the impact of the availability of the transition course relative to the circumstance in which the transition course was unavailable. In this counterfactual circumstance, most students who enrolled in the AHC course would have taken another math or English course.

3.5 Supplemental Findings: Score Distribution on College Assessment Tests

We would like to know whether students who do participate in the AHC program are improving on measures of college readiness. To determine college readiness at entry, the CUNY system uses a variety of assessments including the SAT, ACT, Regents, or the CUNY Assessment Tests (CAT) to determine whether students satisfy the reading writing and mathematics basic skills requirements. Performance on these tests determines whether or not a student may enroll in credit-bearing courses directly or if they must first take remedial coursework in reading, writing, or math. The AHC program encourages students to take the CAT during their senior year while participating in their AHC math or English courses; students are provided with fee waivers so that cost does not deter students from taking the assessment. In this section, we present results for the CAT and discuss the implications for student success in college. These findings supplement our main findings and add context to the overall conclusion that the program is neither effective nor detrimental. Because we disproportionately have CAT scores available for AHC participants compared to non-participants, we report the scores only for AHC participants and emphasize that these descriptive findings are not intended to be interpreted causally.

Figure 2 and Figure 3 show the performance of AHC students on the Math 2 and Math 1 tests respectively. Students who intend to enroll in CUNY must take the Math 2 test and are routed into college algebra if they score 40 or above. Students who score less than 40 on Math 2 are routed downward and required to take the Math 1 numerical skills/pre-algebra test. In the figures below, the red line indicates the passing score. If students score a 45 or higher on Math 1, then they are placed out of pre-algebra remediation (CUNY, n.d.). Students who do not achieve this minimum score are required to take remedial mathematics if they enroll in a CUNY college. These results suggest that even after participating in the program, most AHC participants do not meet college readiness benchmarks in mathematics.

Figures 4 and 5 present the distribution of student scores for AHC students who took the Reading and Writing CAT exams at the end of their senior year of high school. In comparison to math, students score above the college readiness benchmarks on the English components at substantially higher rates. AHC English students must take a test in reading and writing to place out of remedial English. Students are considered proficient in English if they score 70 or higher on the Reading test and 56 or higher on the Writing Test. Though more students score in the college-ready range on these tests than in the math tests, a substantial proportion of AHC students still fail to meet the college readiness benchmarks in English even after receiving the AHC treatment.

Figure 2
Distribution of Math 2 (Algebra) CAT Scores for AHC Math Students

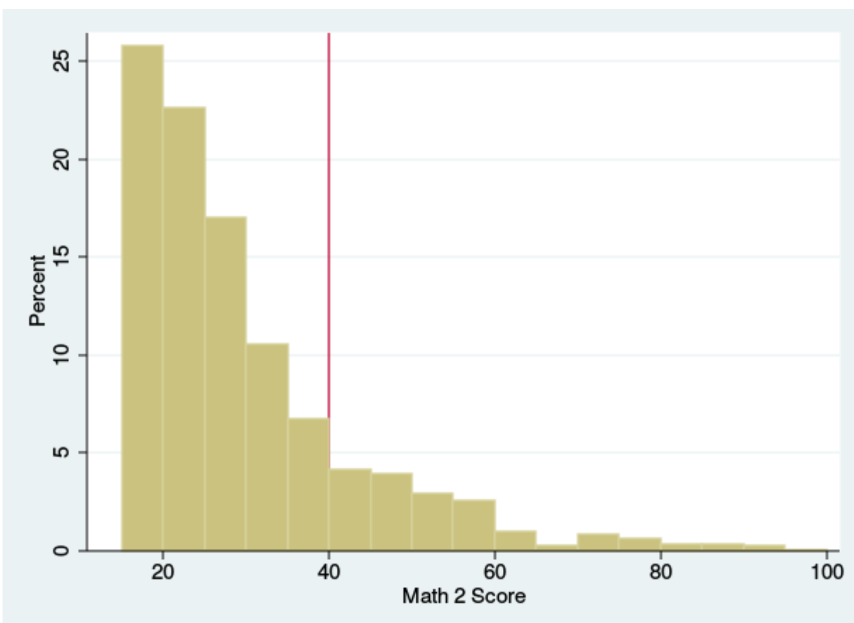


Figure 3
Distribution of Math 1 (Pre-algebra) CAT Scores for AHC Math Students

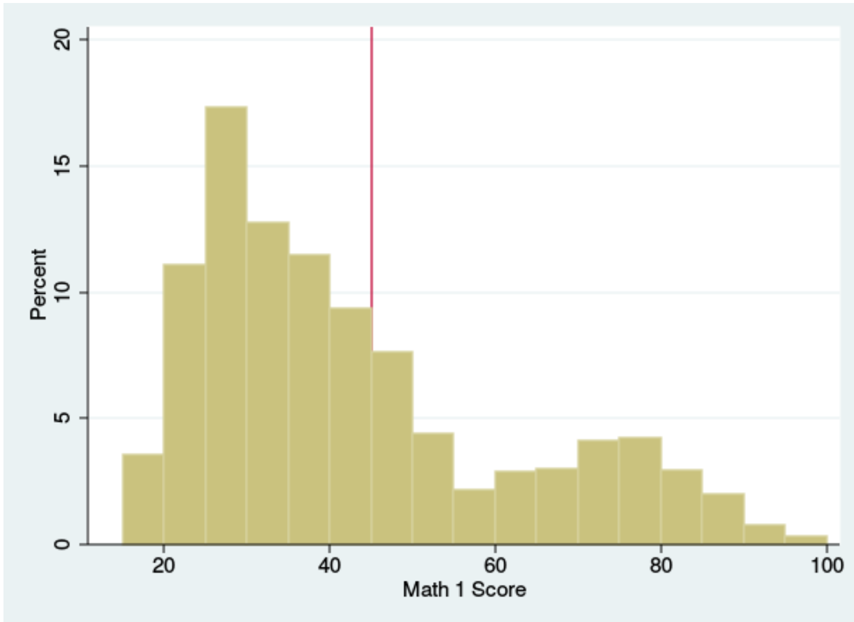


Figure 4
Distribution of Reading CAT Scores for AHC English Students

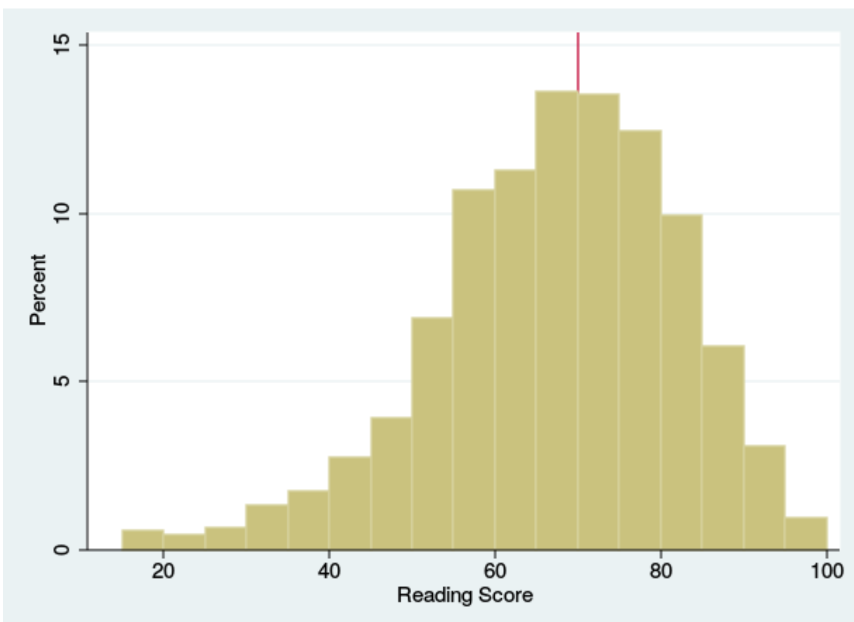
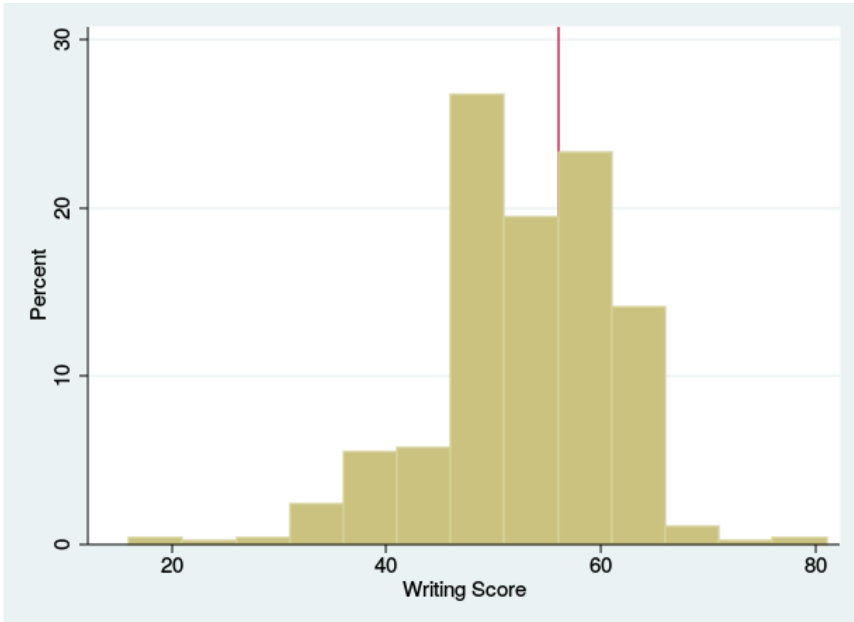


Figure 5
Distribution of Writing CAT Scores for AHC English Students



4. Discussion and Conclusion

Using a DID methodology, we find mixed evidence on the impacts of participation in the At Home in College program. Attending a school that offers AHC math leads to a slightly higher likelihood of passing a gatekeeper mathematics course within one year of graduating high school. However, attending a school that offers AHC English leads to a reduced likelihood of achieving college readiness in reading and writing upon entry into a CUNY college. We also find that the availability of AHC in either subject results in an increased number of college-level credits earned within one year following high school graduation (about one additional credit than a student would otherwise earn). Under alternative model and sample specifications, there is some variation among these impact estimates; in most specifications, these primary outcomes are mostly slightly positive or not statistically significant. Taken together, these results suggest that offering the program is likely neutral to mildly beneficial and at least not harmful to high school seniors. Though limited, these impacts are promising relative to impacts found for similar programs in other states. In particular, a study using a regression discontinuity design to evaluate mathematics transition courses in West Virginia found largely negative impacts of course participation.

Though AHC and the West Virginia transition courses are similar in that they target students who have not met college readiness benchmarks in either math or English by providing them with an intervention to improve their math and English skills, they differ in other key ways. For example, the AHC program embeds a college readiness component in which a high school counselor teaches some class sessions; the program is clearly affiliated with the CUNY system, and students are even invited to visit a CUNY campus to take the placement test at the conclusion of the course. Students may therefore perceive the AHC course as one that is truly intended to help them get ready for college. In West Virginia, the perception of many students seems to have been that they were in a lower-level course; they therefore may have worried that they were not "college material" (Pheatt et al., 2016).

In both states, the models replace a standard senior year math or English course with a transition course in math or English. Also in both states, a large number of students still fail to meet college readiness benchmarks on college placement tests administered after receipt of the course, suggesting that a single transition course alone may not be enough to achieve college readiness, at least as measured by a placement test. Because the counterfactual typically includes a college-preparatory course of some kind that is displaced in favor of the treatment, it is important for policymakers and educators implementing transition courses to carefully consider the unintended consequences of removing students from alternative courses. If the alternative courses are already rigorous, well-taught, and packed with content that is useful for college success, the transformative impact of a transition course may be limited.

Further research needs to be conducted, both in New York City and elsewhere. There is still a need in the research literature to assess learning gains among transition course completers, which can be difficult to assess using administrative data. There is also a need to delve into the specific components of transition course models that may make these courses more or less successful. Finally, as colleges around the country innovate to streamline and strengthen remedial pathways for students, research that illuminates the intersection between high school transition reforms and college pathways is particularly welcome.

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