Which High School Experiences and Outcomes Matter for Attaining a College Degree

Following the Maryland High School Class of 2016 through High School and College

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November 2026

This research was supported by the Maryland Longitudinal Data System (MLDS) Center. We are grateful for the assistance provided by the MLDS Center. All opinions are the authors' and do not represent the opinion of the MLDS Center or its partner agencies.

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Introduction

The importance of a high school diploma has never been clearer. Over the past 20 years it has been recognized by parents and students, as well as by educational policy and practice, that a high school diploma is no longer an endpoint on the road to adult success but an essential stepping stone to postsecondary schooling or training (Orfield, 2004). In the shifting economic landscape of the 21st century, a high school diploma alone is not enough to launch young adults towards family-supporting incomes (Holzer & Baum, 2017). Thus, beginning in the mid to late 2000's, education advocacy groups, foundations, coalitions of higher education institutions and federal and state policymakers began to work in earnest to adjust high school graduation requirements to better align with their emerging view of the high school preparation required to graduate high school ready for postsecondary schooling (Achieve, 2012; Conley, 2008).

Postsecondary education is of course only one of several paths available to high school graduates following the completion of secondary schooling. In pursuing their careers, some students will enter the labor force directly after completing high school, while others might pursue apprenticeships, join the military, or enter career, vocational, or technical training programs. Interest in alternative to college has grown, as the cost of a college education has increased. That said it is also true that the majority of high school graduates enroll in two year or four colleges in the immediate year following high school graduation, and by their mid-20's closer to 80% of an age cohort as enrolled in an institution of higher education. Part of this is driven, by the ever-increasing share of higher paying jobs going to college degree holders.

Currently, many students who earn a high school diploma, however, face low odds of achieving postsecondary degrees. Nearly a third of students who enroll in college do not earn a bachelor's degree by the six-year mark, according to the National Student Clearinghouse (Shapiro, et. al., 2018). The numbers are far worse for students from high-poverty schools and for students of color. Students from low-poverty high schools are more than twice as likely to earn a degree in six years than their peers from high-poverty schools. Graduates from schools with high rates of poverty and high numbers of minority students have the lowest degree completion rates of all (27 percent compared to 51 percent of those from high-income, low-minority schools). Gaps between the disadvantaged and other students in high school achievement are compounded by lower completion rates in postsecondary programs and poor performance during college, hurting their later earnings and labor market outcomes (Backes, et. al., 2014). Thus, a critical question is how high school outcomes can be improved to increase postsecondary success.

One view of what high school outcomes matter in terms of postsecondary success focuses on the number, sequence, and types of courses students take and pass to earn their diploma

(Chaney, Burgdorf, & Atash, 1997; Clune, White, & Patterson, 1989). This is seen as a broad measure of obtaining the types and levels of knowledge and academic skills needed for later success. Based on analyses of NELS:88, Adelman (2006) argued that the sequence of courses high school students took was one of the most important determinants of postsecondary educational attainment.

Increasing the number of courses students need for graduation and intensifying the academic focus of those courses, was the primary state policy response to the Nation at Risk report in the 1980's and then again in the call to better align high school graduation requirements with college readiness in the mid 00's. This has typically resulted in increasing mathematics and science credit requirements, and in some cases thereby increasing the total number of credits needed to graduate (Achieve, 2012). Selective state and private colleges and universities, moreover, typically require high school students to earn credits in a college preparatory sequence of high school courses to be considered for admissions (Jimenez & Sargrad, 2018). As such, some states aimed to make a diploma linked to college readiness the normative outcome for high school graduates. Alabama is a prime example, as it made the college preparatory sequences of courses, now including 4 credits in English, 4 in Mathematics, 4 in Social Studies and 4 in Science, the default curriculum required for graduation for all students, rather than a choice to opt into (Chattin & Hackmann, 2013). A related course of action was to make college readiness, typically tied to specific course sequences, a key metric in state accountability systems for high schools and districts. California, for example, created its A-G course sequence, 16 core academic courses along with syllabuses aligned to the expectations of the state university system, and made the percent of high school graduates achieving it a key expectation of the state accountability system for districts and high schools (Rumberger, 2018).

Within this policy-based rise in high school credit accumulation, there remains great variation by state, and in many states by school district within states, in the number and types of classes students must pass to earn a high school diploma. Some states are very prescriptive and mandate a large number and type of credits for all high school graduates; others establish a bare minimum and then allow/encourage school districts to set additional requirements. The total number of credits students can have the opportunity to earn also varies greatly by place. Some schools and districts operate on 6-period days, which enable 24 credits to be earned over four years, while others using various forms of block scheduling can provide students access to up to 32 credits over four years, and eight per year. Other districts, sometimes as the result of fiscal challenges, offer students 5 credits per year, or 20 overall. To date there has not been much empirical analysis looking at different combinations and amount of course credits on postsecondary outcomes. There has only been a general view that more is better, based largely on the finding that the most advanced mathematics and science classes have value (but perhaps in part because they are rare) (Adelman, 2006), and a general reliance on the

admissions requirements of higher education institutions to establish which courses actually matter.

Another set of arguments with regards to what makes a high school diploma meaningful for postsecondary outcomes has focused on high school graduates' grade point average (GPA). The argument here is that the combination of knowledge, academic and non-academic skills needed for postsecondary success are best captured by the grades students receive in their classes. The school success skills that proponents of GPA argue are associated with good grades include the ability to do independent work, self-regulate learning, study, manage and complete multiple assignments, and learn how to successfully navigate the personalities, expectations, and teaching styles of multiple instructors (Farrington, 2014; Galla et al., 2019; Lleras, 2008; McDermott et al., 2019). This focus on the importance of GPA is informed by longitudinal studies that have found significant positive effects of high school GPA on both postsecondary education and labor market earning outcomes (Allensworth & Clark, 2019; French, Homer, Popovici, & Robins, 2015) as well as college administrative datasets that permit multivariate analyses using placement test and high school GPA data (e.g., Belfield & Crosta, 2012). Educators and policymakers cite these studies to support the mantra that a B or better GPA in high school signifies readiness or at least decent odds for success in postsecondary schooling.[1] Emphasis on GPA has led to news stories about teachers feeling pressured to give students passing or better grades (e.g., Edelman, 2015) and research and commentary about high school grade inflation (Gershenson, 2018). In addition, research by Allensworth and Luppescu (2018) has shown that potentially there is some explicit or implicit bias in grading particularly in the case of Black males. The validity of the GPA-matters-most argument is threatened if accountability, social or parental pressures, and/or bias induce teachers to give grades that are not tightly aligned to knowledge, academic and non-academic skills students are demonstrating. It is also not known if the significance of high school GPA for future outcomes is largely rooted in its relationship to persistence and attainment in four-year colleges and universities, rather than two-year or occupational certificate programs. One recent study found that, while overall degree attainment was low, students with both very low and very high, high school GPAs from a northeastern city succeed in earning two-year degrees at similar rates (Balfanz & Byrnes, 2019).

[1] The Belfield and Crosta (2012) study estimates that a C+ high school GPA predicts at least a C college GPA.

A Lack of Empirical Evidence and the Rise of State Longitudinal Data Systems

Thus, from about 2008 to 2014, many states rapidly increased graduation requirements in one form or another in efforts to better align high school graduation standards with college and career readiness. The impact of this policy push can be seen in Figures 1 & 2 below which show the average number of credits earned by U.S. high school graduates for four cohorts of students, as per the National Assessment of Educational Progress (NAEP). Since 1990, students are earning on average 4 more academic credits, in particular 1 each in math and science. Over the same time frame, between 1993 and 2019, the number of states requiring at least three credits in math grew from 15 to 44 (ECS, 2019). In 2019, the national average was 28.1 total credits earned in high school compared to 23.6 in 1990. The number of academic credits high school students earned increased from 16.7 in 1990, to 18.9 in 2000 and 20.8 in 2019 (25% increase over 30 years). By 2018 the average high school graduate was earning 4.5 English, 4.2 Math, 4.0 Social Studies and 3.7 Science credits, which is above and beyond most states' minimum requirements and the highest level recorded. If more academic credits translate into higher postsecondary readiness, graduating classes in the late 2010's, would be the best prepared high school students in generations.

Figure 1 - Number of credits earned by U.S. high school graduates, NAEP

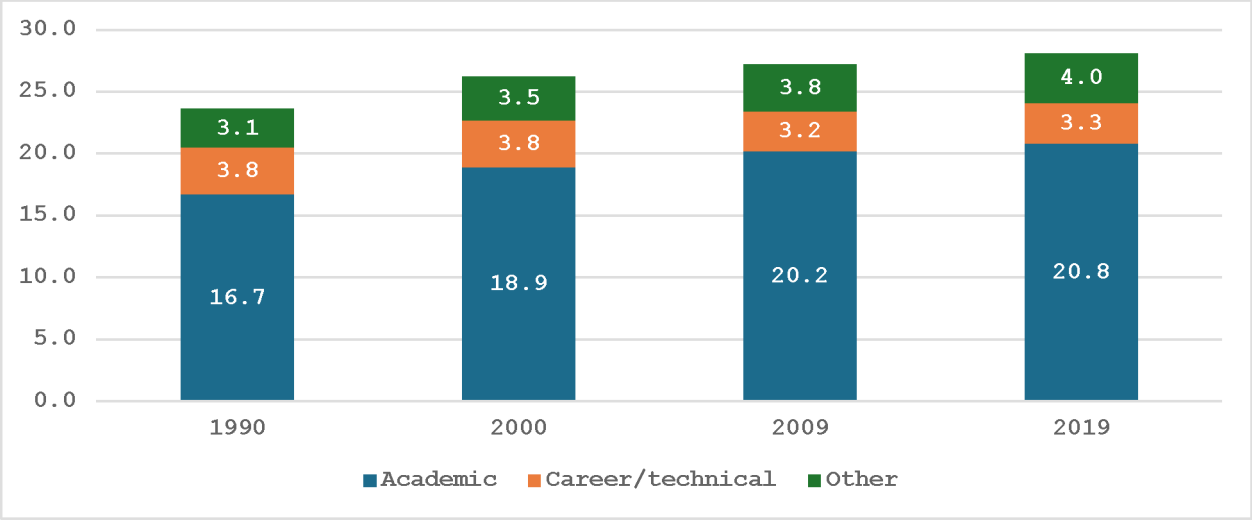
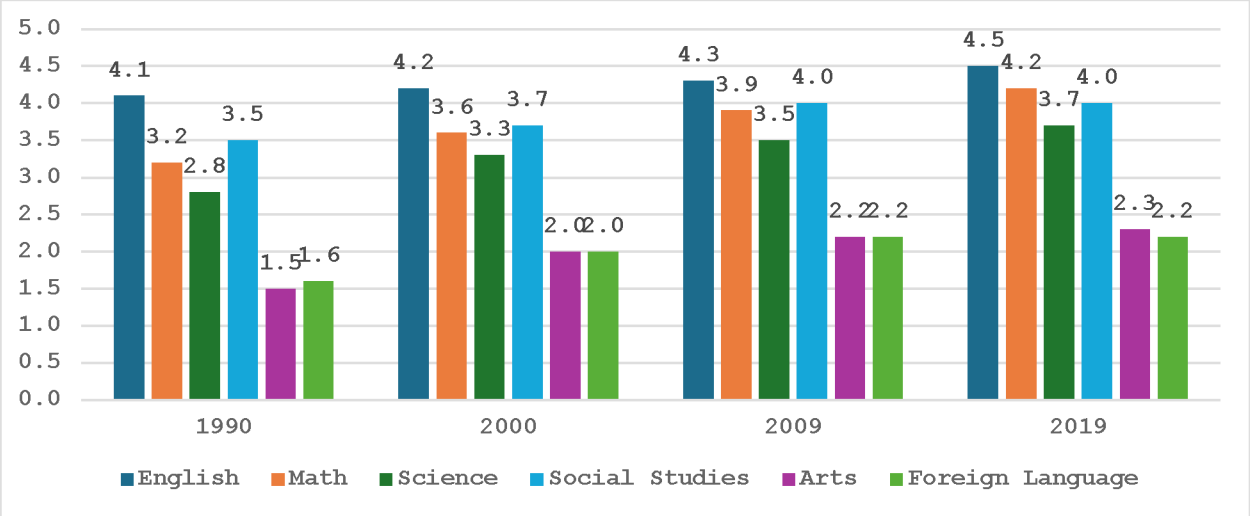


Figure 2 - Average Carnegie credits earned by U.S. high school graduates, by academic course subject, NAEP



To date, policy changes to high school graduation requirements have largely been based on educational and political judgements of what matters, not empirical studies of the postsecondary success rates of students with different levels and types of performance and preparation in high school (Koretz, 2017). State and local high school graduation requirements have mainly been based on the insights and judgements of school district leaders, school boards, and state legislators. The stakes now, however, are arguably higher, as it has become clear that nearly all students need some postsecondary schooling or training to have good odds of securing a pathway to adult success. Thus, it is essential to both educational policy and practice that more empirical light be shed on how many, and which high school courses really matter, with what level of performance, for success in postsecondary schooling.

The longitudinal data sets needed to empirically examine the relationships between various levels and types of high school performance and postsecondary success, for the most part, did not exist through the graduation requirement debates of the past two decades (Princiotta, et. al., 2014). Two nationally representative studies were conducted by the National Center for Education Statistics (NCES), the National Educational Longitudinal Study (NELS, '88) and Beginning Postsecondary Study of 2003-04 to 2008-09 (BPOSTSECONDARY:04/09). Both sets of data apply to high school graduates in the 1990's. Analysis of these studies, conducted by Child Trends, found that the strongest high school academic predictors of postsecondary completion were high school GPA, followed by a similar group of SAT/ACT scores, highest math course completed, earning a college credit in high school, and completing an AP course (Princiotta, et. al., 2014). Though, only high school GPA was statistically significant after controlling for other background factors, and a consistent indicator across all postsecondary categories (4-year, 2-year, less than 2-year). Neither of these data sets, however, enable analysis of postsecondary readiness from 2000 forward, during which high school and college enrollment rates grew

considerably, and high school graduates earned more academic credits.

The Obama administration provided federal funds to develop state longitudinal data systems, these data systems, however, did not become quickly operational in most states. Many found the linking of K-12, higher education, and labor market data a formidable challenge and to date, only 25 states have longitudinal data systems which fully link pre-K through workforce data (ECS, 2024). As a relatively recent development, State Longitudinal Data Systems offer the potential to provide states and local school districts with empirical evidence of which courses and how many with what level of performance have the greatest impact on a student's ability to attain two- and four-year college degrees, enabling the state and local school districts to direct resources and staffing to where it will have the greatest impact on postsecondary success.

For example, analysis by the Everyone Graduate Center, conducted for the school district of Boston, showed that students who completed a course sequence which had more laboratory science and foreign language courses than were currently required for graduation, had a much higher success rate in four-year colleges, all else being equal, than students who did not take these courses (Balfanz & Byrnes, 2019). The district had been reluctant to add these courses to all high schools because of the added expense of science labs and the challenge of recruiting foreign language teachers given that there was no evidence which demonstrated their value. Once they had the empirical analysis, they had their evidence and decided to change their policy.

In another example, the focus of this study, the state of Maryland, commissioned the American Institute for Research (AIR) to conduct analyses with the Maryland Longitudinal Data System (MLDS) to help it refine its college and career standards. The Blueprint for Maryland's Future Act passed in 2021 requires high school students to by the end of 10th grade and no later than 12th grade demonstrate that they are ready to be successful in first year, credit bearing coursework in a community college or open enrollment institution. The state' adopted in interim policy that measured this outcome by student's performance on state assessments. The law, however, required the commissioning of a study to establish the best ways to demonstrate students are meeting this standard. AIR conducted this research and used the MLDS Center to examine the impact of performance on state assessments, High School GPA, and course grades, among other variables, on student's ability to meet the state's college and career readiness standard, examining the first-year college outcomes of Maryland high school students from the graduating classes of 2017 to 2021. The analysis showed that GPA and course grades in math and English could provide an alternative means of establishing a students college readiness (Rickles et. al. 2023). This analysis helped inform further revisions to the state policy, which created multiple ways for high school students to meet the state college and career standards (Maryland State Board of Education 2025).

This Study

As part of larger project examining three states[2] -Maryland, Michigan, and Minnesota- this study conducted by the Everyone Graduates Center at Johns Hopkins University, focuses on Maryland, one of the states whose longitudinal data system allows us to examine the relationship between high school credits, courses, grades, test scores and postsecondary success (enrollment and attainment). With its ability to connect records across the K-12 and postsecondary sectors, the MLDS Center provides us with the high school transcript and postsecondary outcome data needed to facilitate such targeted analyses, along with student demographic and background information. With its longitudinal history, it is able to do so for a sample of nearly 50,000 high school graduates from the graduating class of 2016, allowing enough time to examine both late high school graduates (i.e. 5th or 6th year), and for the observed students to have had 6-8 years to obtain postsecondary degrees or credentials. At the same time, this cohort of students remains recent enough for policy relevance, having been in high school during the period in which increased high school diploma requirements became the new norm.

Leveraging the available data, we explore the following research questions:

1. Which high school courses (and related outcomes in these courses – credits earned, grades, GPA, test scores), are most predictive of postsecondary success (enrollment, persistence, diploma, for 2 and 4-year programs)?

2. How much variation is there across districts in the percentage of students attaining the set of courses, and outcomes in them, that are most associated with postsecondary success?

The impetus for this study is to demonstrate how state longitudinal data system can provide states and local school districts with empirical information to enable them to make informed decisions about what courses and how many, their students should take, as well as what level of performance in high school courses matters, in order to graduate prepared to succeed in two- and four-year degree programs. This research can help states and local education agencies (LEAs) revisit and modernize high school graduation requirements (and potentially postsecondary admission requirements) to improve student access to and success in college. In the course of using state longitudinal data systems towards these ends we also aim to learn more about the strengths and limitations of these systems in identifying what about the high school experience matters most in preparing students for college success.

[1] The study was funded by the Joyce Foundation and supported by New America.

Methods of Analysis

We explored the relationship between students' high school credits, courses, grades and test scores and their postsecondary outcomes first through descriptive analyses examining the postsecondary outcomes of students depending on the total number of credits they earned in high school, their overall GPA, the completion of specific courses, as well as the number of credits earned in specific subject areas (mathematics, English, science, social studies, foreign language, computer science, etc.) and their performance on the math and English tests required for high school graduation in the 2010's in Maryland. Working with limited earlier availability of high school course data in the MLDS, while also allowing sufficient time for students in the data set to have enrolled in and completed a postsecondary program, we drew on the 2016 high school graduating class. At the time the analytic dataset was constructed, postsecondary data were available through the 2022-23 school year, and so our analyses reflect postsecondary enrollment and awards up to seven years after high school graduation. To ensure the most complete high school outcome data possible, we limited the analytic dataset to those students with data in the MLDS from each year in high school, grade 9 through grade 12. This resulted in a final analytic data set of 49,670 graduates. Descriptive analyses of this dataset allowed us to visually explore the relationships between students' high school achievements and their postsecondary outcomes through charts and figures.

We then examined the relationships between combinations of high school indicators and postsecondary outcomes to see if particular groupings of indicators are highly predictive of college degree attainment. We make use of the large sample sizes available to us through a state longitudinal data system to conduct propensity score matching to minimize selection effects. Students who take certain high school courses, such as advanced math courses, may do so for other reasons, such as motivation, self-efficacy, family background, or prior achievements, that in turn also lead to greater postsecondary success. By matching students who earned certain high school credits to other students who did not, but who had similar demographic backgrounds and similar 9th grade GPAs, we can create a quasi-experimental design whose results provide us with a level of causal evidence of the relationship between students' high school and postsecondary outcomes.

All analyses of postsecondary outcomes distinguish between four-year diploma and two-year degrees to determine if there are different sets of high school indicators that are linked to success for each degree. Similarly, analyses also examine outcomes for both public and private institutions. Appendices A-I display the results of all our analyses, while the report below highlights the most significant and relevant findings.

The Context in Maryland

Maryland has had an evolution of its high school graduation requirements, from the graduating class of 2016, the focus of this study, to its most recent graduating high school class in 2026.

The cohort of students observed in this study graduated in 2016 and thus were not subject to current graduation requirements. At the time of the 2016 cohort's graduation, high school graduates statewide were required to complete 21 total credits, with a certain number of credits required to come from various subject areas: 4 from English, 3 each from math, science, and social studies, 1 each from fine arts and technology education, and 0.5 each from physical education and health education. High school graduates were also required to earn credits in at least one elective area: 3 from career & technical education, or 2 from either foreign language or advanced technology. Each of the 24 local school systems had the potential to add requirements beyond those determined by the state and some did. These additional requirements most frequently involved a higher overall credit requirement (up to 26 total credits, in some districts), or a requirement for 4 math credits rather than 3.

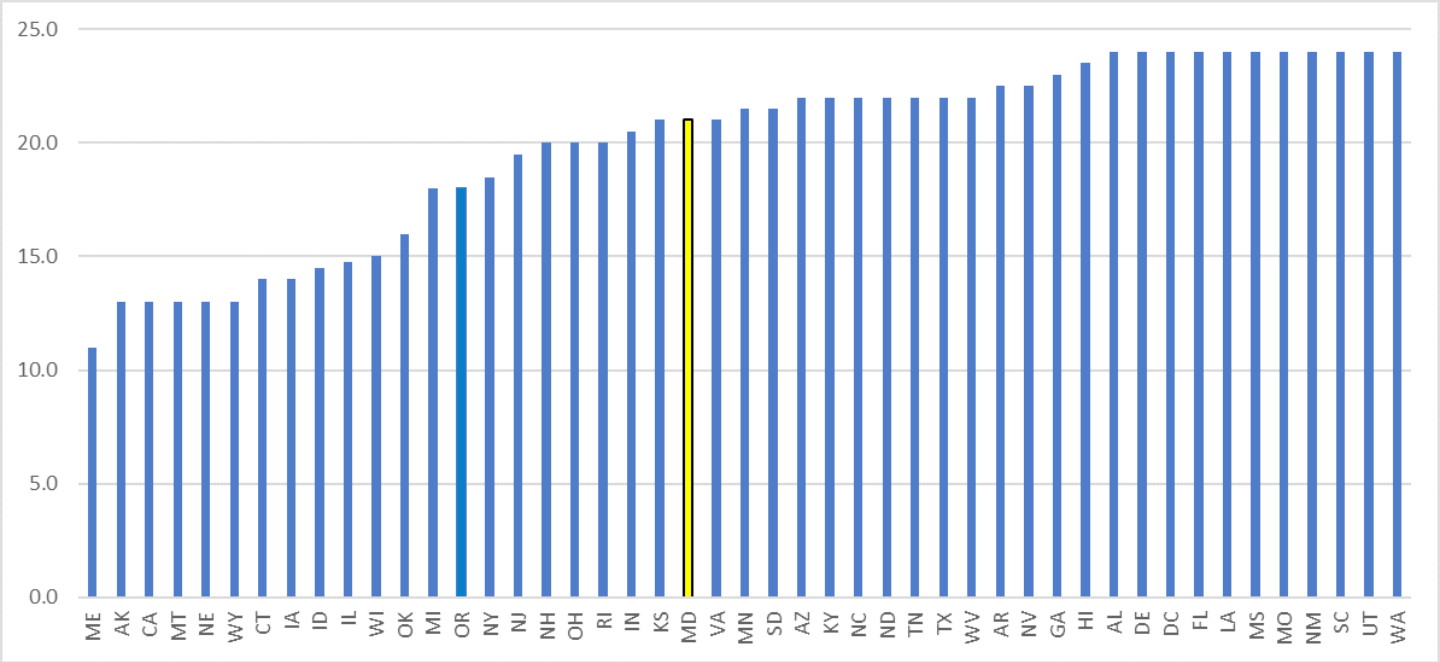
In terms of credit counts, the primary changes to the statewide graduation requirements beginning in 2021-22 were in the areas of math (an increase from 3 to 4 credits) and health education (an increase from 0.5 to 1 credit). Current math requirements further specify that students must take a math class each year of high school, including successfully completing Algebra I and Geometry.

As noted in the introduction, Maryland in recent years has been working to establish and revise it college and career ready standards in response to the Blueprint for Maryland's Future Action in 2021. This has a resulted, in a major change to graduation requirements. The Class of 2016, in addition to earning the required number and distribution of credits, also had to reach certain cut points on high school assessments given in Algebra, Biology, English and Government or complete a Bridge project for subjects where cut points were not achieved. The Class of 2026 has to take state assessments, in Algebra, English 10, Life science/Biology and American Government, but do not need to reach a set cut-point. Rather the assessments now factor into end of course grades, with weights locally determined. Students are asked to demonstrate their college and career readiness through combinations of course grades, assessment scores, or CTE outcomes.

Despite these changes, there is still much to be learned through an analysis of the college outcomes of the graduation class of 2016. To earn a high school diploma in 2016 or 2026, high school students needed to succeed in 21-22 high school courses and earn a minimum number of credits in each academic area and across specific electives or elective areas. They were also asked to demonstrate academic skills as captured by state subject specific assessments in 2016 and in 2026, additionally this could be demonstrated through, nationally normed assessments

(i.e. ACT, SAT, PSAT, and Workkeys) or college levels courses (AP or Dual Enrollment). A key question in 2016 and 2026, is which of these requirements matter the most for college success.

Figure 3 - Total course credit requirements for a standard high school diploma, by state: 2019



Another potential factor in setting graduation requirements is what the state university system requires of students for admissions. In many states there is a disconnect in the alignment between high school diploma requirements and postsecondary admissions requirements (Princiotta, et. al., 2014).

As of the most recent policy on undergraduate admissions, amended in June 2022, the University System of Maryland set as general minimum requirements the equivalent of 16 total credits: 4 years each of English and math, 3 each of biological/physical science and social science/history, and 2 of language other than English. Incoming undergraduates are required to have completed Algebra I, Geometry, and Algebra II among their mathematics courses, and to have a high school GPA of C or better. Maryland's flagship institute, the University of Maryland, College Park (UMD) adheres to these credit requirements as minimums, as do the other two largest traditional universities in the USM, Towson University and University of Maryland, Baltimore County. These minimum requirements for USM institutions broadly align with the subject-specific credit requirements set by MSDE for high school graduation (and USM admission requirements were a cited factor in the high school graduation task force's recommendations) but it is still possible for a high school student to graduate in Maryland and not meet these requirements-in particular by not taking two years of foreign language or Algebra II. UMD also notes that the most competitive freshman applicants have a high school

GPA of B+/A- or better and record several honors, Advanced Placement, or International Baccalaureate credits.

Is More High School Credits Better?

There has been a strong belief over the past decades that earning more high school credits, and taking more advanced courses, leads to high school graduates who are better prepared for postsecondary success and should be mandated as part of high school diploma requirements in order to raise students' postsecondary outcomes. To test this belief, we explored the Maryland longitudinal data and examined the observed experiences of past students. Did the total number of credits earned in high school impact students' postsecondary attainment? Did students who earned more than the minimum number of credits required by the state do better in postsecondary? Did every additional credit matter? Did some credits matter more or less than others?

At the time that students in this study graduated from high school, Maryland required a minimum of 21 credits, placing it around the median in statewide required credits. As mentioned, however, districts can add additional graduation requirements, resulting in a range of 21 to 26 required credits across the state. The median number of total credits earned for high school graduates in our sample was 26, but there was a wide range of earned credits against which we can compare postsecondary outcomes, with roughly one in four students earning 30 or more.

As a starting point, the postsecondary outcomes for our full sample of Maryland students can be seen in **Table 1** below. Seventy-nine percent (or close to 8 out of 10) of Maryland high school students from the class of 2016 graduated from high school and enrolled in a postsecondary institution within six to eight years of their on-time high school graduation date. This indicates that the vast majority of Maryland high school graduates from the class of 2016 sought a postsecondary degree. Slightly more of those students enrolled in a 4-year degree granting institution than in a 2-year degree granting institution (and 82% enrolling in public institutions)[3]. Postsecondary degree attainments, however, were not as strong. Among all high school graduates in our sample, fewer than half (42.4%) earned a postsecondary award of any kind. Less than 1% of the high school graduates from the class of 2016 earned a certificate from a two-year institution as their highest degree, and 6% earned an Associate degree. Roughly 36% earned a Bachelor's degree or higher. Overall, just a little more than half the high school graduates (53.6%) from the class of 2016 who enrolled in postsecondary institutions earned a degree or certificate within six years (including high school students who graduated high school in five or six years).

[3] Our data sample observes students for 6-8 years after high school graduation, so the overall enrollment numbers include students who enrolled years later and not just in the year immediately following high school graduation.

By comparison, data from the National Student Clearinghouse reports that nationally, 62.2% of the high school cohort of 2017 who enrolled in an institute of higher education earned a postsecondary degree within 6 years of high school graduation.

Table 1 - Postsecondary Outcomes, High School Graduates from Class of 2016

Postsecondary Enrollment				
Any PS Enrollment	**2-Year Enrollment**	**4-Year Enrollment**	**Public Enrollment**	**Private Enrollment**
79.0%	45.3%	54.6%	82.1%	17.8%
Postsecondary Attainment				
Any Award	**Certificate**	**Associate**	**Bachelor**	**Graduate**
42.4%	0.6%	6.1%	33.4%	2.2%

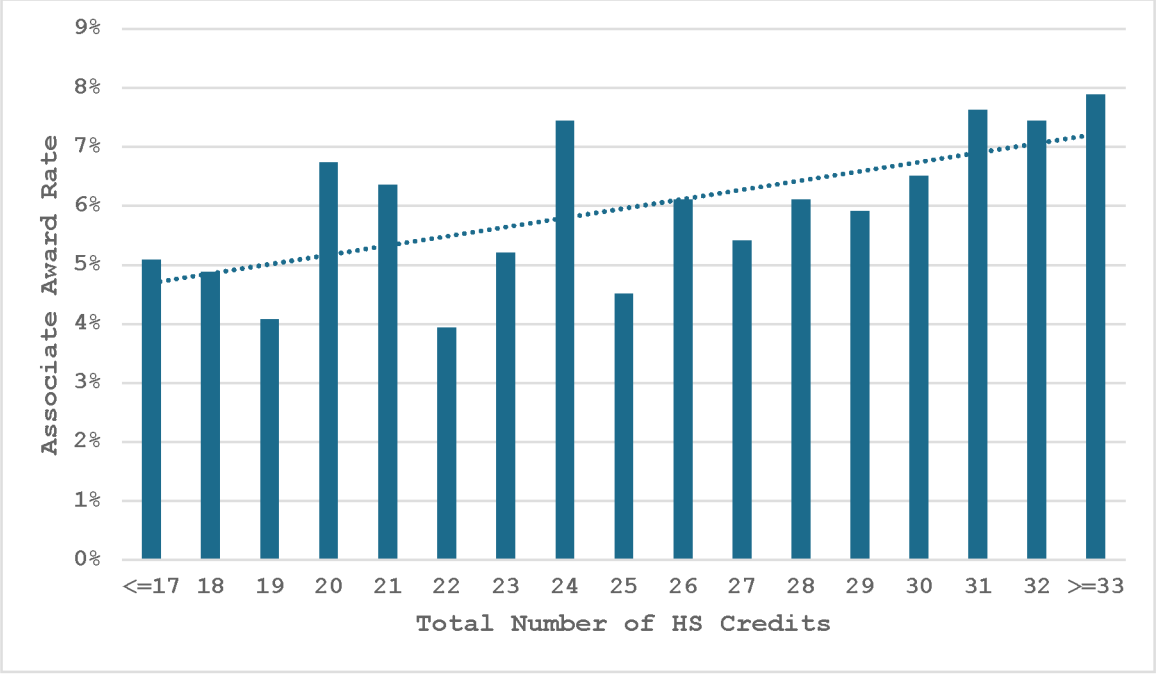
As seen in **Table 2** below, the relationship between the number of high school credits earned and postsecondary outcomes ***indicates that earning more high school credits is not linearly associated with better postsecondary outcomes***. In fact, high school graduates who earned 21-23 credits, around the state minimum, have postsecondary outcomes that are better than those who earned 24 to 29 credits, earning Bachelor's Degrees at rates 10 to 13 percentage points higher. Postsecondary attainment rates are also higher among students who earned 30 or more credits. Of note, this relationship between high school credits and postsecondary outcomes for student earning 30 or more credits is bound up in GPA: students with an "A" high school average were three times as likely to complete 30 or more credits as those with a "C" high school average. Even in combination with better grades, earning nine to twelve more credits than the state minimum (almost a 50% increase), is only associated with a three percentage point gain in Bachelor's degree attainment and had no impact on associate degree attainment.

Table 2 – Postsecondary Outcomes by Total High School Credits Earned, MD Class of 2016 High School Graduates

Total HS Credits Earned	N =	Enrolled in PS	Any PS Award	Associate	Bachelor's or Higher
18-20 Credits[4]	2734	66%	26%	6%	20%
21-23 Credits	6658	78%	45%	6%	38%
24-26 Credits	7316	71%	32%	6%	25%
27-29 Credits	9327	75%	35%	6%	28%
30-32 Credits	11561	85%	49%	7%	41%
≥33 Credits	2029	86%	52%	8%	44%

There appears to be little systematic relationship between total high school credits earned and obtaining an Associate's degree, **Figure 3**. Regardless of how many credits students earned in high school, only between 4 and 8 percent are earning Associate degrees.

Figure 3 - Associate Award Rates by Total Number of HS Credits, MD Class of 2016 High School Graduates



[4] The vast majority of under-credited graduates were recorded from one large district, so some portion of students seeming to have graduated with fewer than the required credits may be due to a reporting issue.

Table 3, below, explores the interaction between students' total credits earned and their high school GPA, as it is possible that the number of credits earned mattered more or less for different groups of students. However, looking at students with a high school GPA of "A", there was little difference in their postsecondary outcomes (completing any award and earning a Bachelor's degree) even with additional credits. High school graduates with an "A" average who earned between 21 and 23 total high school credits had similar postsecondary outcomes to those who earned between 30 and 32 credits. "A" students were generally earning more high school credits than the minimum, and this may have been beneficial for them in some way, including increasing their competitiveness for selective institutions. It did not, however, lead them to earn college degrees at higher rates than "A" students who earned the state minimum number of credits.

A different, and on face value somewhat inexplicable pattern, emerged for students with a "B" average GPA in high school. For these students, more appears to have been worse. Among these students, postsecondary degree and bachelor's degree attainment were highest among those earning 21-23 high school credits. Beyond that, more total high school credits were associated with less postsecondary achievement among students with a "B" GPA.

Table 3 – Postsecondary Outcomes by HS GPA & Total Credits Earned, MD Class of 2016 High School Graduates

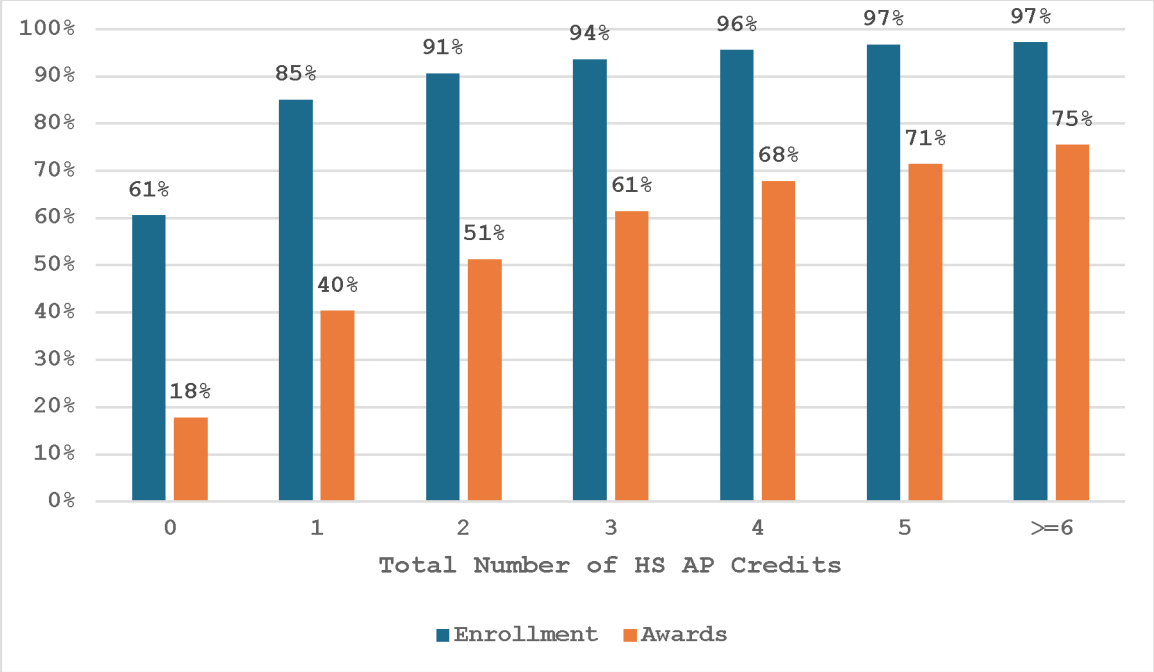
HS GPA	HS Credits	N	Any PS award	Bachelor
"A"	**18-20**	238	74%	66%
	21-23	408	81%	74%
	24-26	582	76%	66%
	27-29	1,463	79%	72%
	30-32	3,362	81%	75%
	>32	816	78%	72%
"B"	**18-20**	629	46%	34%
	21-23	2,684	66%	60%
	24-26	2,479	51%	41%
	27-29	3,960	42%	33%
	30-32	6,007	44%	34%
	>32	1,032	39%	28%

Looked at several ways, the result is the same, with all else being equal, students who earned the minimum number of high school credits required to graduate, earned postsecondary degrees at the same or better rate as students who earned more credits. In terms of total number, more credits is not better for postsecondary success.

Are Some Courses More Important than Others?

What does make a significant impact in relation to students' postsecondary outcomes are Advanced Placement[5] credits. With even one Advanced Placement credit, students' postsecondary outcomes have a substantial boost (**Figure 4**). The biggest impact is demonstrated in moving from no AP credit to one credit, but additional credits continue to bring benefit, particularly for bachelor's degree attainment. So, while the total number of credits earned does not systematically differentiate between students' postsecondary outcomes, it may be that specific credits play a larger role than the overall number. Other recent research based on both state level and nationally representative data has similarly found that Advanced Placement courses improve students' postsecondary outcomes (particularly enrollment in 4-year programs), but that access is not equal as white and affluent students enroll in such courses at higher rates (Djita, et. al., 2023; Xu et al., 2021).

Figure 4 - Bachelor's Award Rates, by Total Number of HS AP Credits for MD Class of 2016 High School Graduates



[5] Results for Advanced Placement courses are based simply on whether students received a high school credit for the course and not based on if the student took the course related to the AP exam, scored 3 or higher on the AP exam, or later received a postsecondary credit for the AP course.

Table 4 revisits one of the cornerstones of the research identifying which high school outcomes mattered most for postsecondary success, students' most advanced high school math credit (Adelman, 1999; Riegle-Crumb, 2006; Schneider, Swanson, & Riegle-Crumb, 1998). Related to this research, under the leadership of Achieve, was the push in the middle to late 00's to get states to increase their high school graduation requirements and require all students to complete up to Algebra 2. Many did so, and the percentage of students taking Algebra 2 rose nationally. As noted in the introduction, Maryland's statewide graduation requirements were raised in 2021 to require four years of math, with 1 or more credits coming from Algebra or from a mathematics course for which Algebra I is a prerequisite (which could, in practice, include Algebra 2). The cohort in this study, the graduating class of 2016, was required to take three rather than four years of mathematics but was still subject to the Algebra requirement. Based on the data from this cohort of Maryland graduates, the greatest benefits of advanced courses occur for courses beyond Algebra 2. In our sample of Maryland high school graduates, those students whose highest math course was Algebra 2 had below average postsecondary outcomes (71% enrolled, and slightly more than a quarter completed an award of any type). The largest differences in postsecondary outcomes, particularly postsecondary degree completion, are found for those students who reached AP/IB level math courses or some level of calculus. This mirrors analyses of longitudinal data from Michigan which found that while Algebra 2 taking was in the past significantly related to students' postsecondary outcomes, once Michigan implemented an Algebra 2 mandate, students needed to advance beyond Algebra 2 to see significant improvements in their odds of postsecondary success (Kim et al., 2018). These findings echo past concerns that if part of the value of Algebra 2 in terms of postsecondary success was as a signifier of students who were more academically successful than their peers, rather than due to mastery of the mathematics content itself, then mandates and increasing enrollments would lower its signaling value and lead students seeking to enroll in four-year and more selective colleges, to take more advanced math courses as part of an ever-increasing credentialling race (Loveless, 2013). Alternatively, the enrollment of all students in Algebra 2 may have shown more students that they can do advanced math, leading them to take more courses. **Regardless of the reason, by 2016, nearly two thirds of Maryland high school graduates earned a credit for a math class beyond Algebra 2, and 38% earned credit for a pre-calculus or calculus course.** If learning advanced mathematics is related to better postsecondary preparation than Maryland high school graduates should be much more prepared than they were at the turn of the 21st century. The general finding, that students taking higher mathematics course typically do better in postsecondary attainment, still holds true, but only for students who take even more challenging courses than Algebra 2. It still remains unknown, if this reflects the math content knowledge or is a more general signal of the ability to do well in challenging courses.

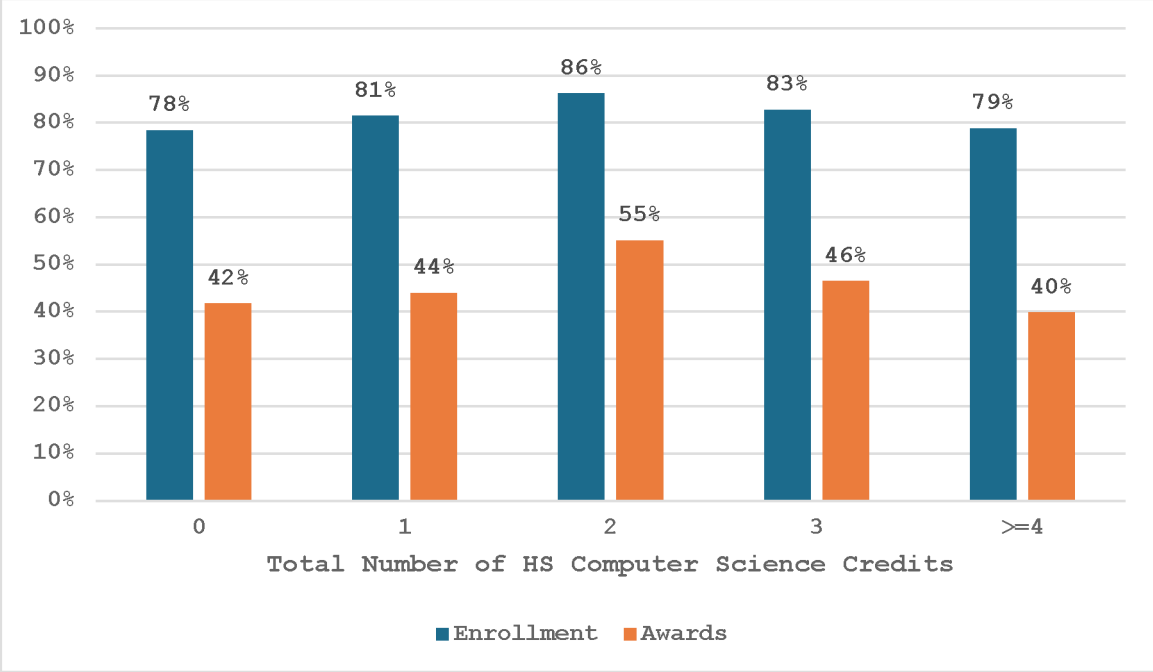
Table 4 - Highest HS Math Credit Earned and Postsecondary Outcomes, MD Class of 216 High School Graduates

	% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor
Geometry	8%	47%	38%	9%	9%	4%	5%
Algebra 2	25%	71%	46%	25%	27%	7%	19%
Trigonometry	7%	81%	42%	39%	39%	8%	30%
Other Advanced Math	10%	77%	41%	36%	34%	7%	27%
Probability/ Statistics	9%	69%	41%	28%	28%	7%	20%
Other AP/IB	2%	92%	34%	58%	58%	7%	50%
Pre-Calculus	21%	91%	32%	58%	57%	6%	50%
Calculus	3%	94%	23%	72%	70%	6%	63%
AP/IB Calculus	14%	97%	14%	83%	78%	3%	74%

Computer Science appears to be another case where taking a specific course is not associated with improved postsecondary enrollment or attainment outcomes. As seen in **Figure 5**, students had similar postsecondary enrollment or completion rates regardless of if they earned 0, 1, 2, 3, or 4 or more computer science credits. The completion of a computer science course and the mastery of the related content might relate to other important outcomes such as future earnings or may matter to individual students interested in pursuing computer science in college or spark interest in a subject or career that students had not previously considered. The Maryland Center for Computing using MLDS data has shown that substantial numbers of high school graduates from the class of 2016 who took a computer science course in high school did end up majoring in computer science or a related field in college (MLDS Center Computer Science Dashboard 2026[6]). There is no evidence in the Maryland data, however, indicating that states or school districts should require computer science of all high school graduates as a means to increase their general postsecondary readiness. As of a recent report (ECS, 2023), seven states require students to earn credits in computer science to complete a high school diploma. Maryland state requirements include it as an option, as students entering 9th grade in SY2021-22 and later need to take one computer science/technology/engineering credit.

[6] https://mldscenter.maryland.gov/ComputerscienceDashboard.html

Figure 5 - Postsecondary Outcomes, by Total Number of HS Computer Science Credits, MD Class of 2016 High School Graduates



What Do Grades Have to Do with it?

Another view on what matters most in high school, is that it is not just how many or what courses you take, but how you do in those courses. This relates to the research which has found high school GPA to be among the strongest predictors of postsecondary success, and the idea that GPA not only signifies mastery of content, but also a student's mastery of the skills needed for postsecondary success such as productive persistence, self-regulation, and time management. Grades have not been part of a typical high school diploma requirement system, and shouldn't necessarily be so, but are important to explore and understand. Aside from exploring the association of course grades with postsecondary outcomes, we also wish to know, does it matter which courses you get good grades in? What are advantageous combinations of grades earned, and courses taken in terms of postsecondary attainment?

Overall GPA

Table 5 shows the postsecondary outcomes for Maryland high school graduates based on their high school GPA. Among the class of 2016, the modal overall GPAs were "B" and "C." Similar percentages of students graduated with each of those GPAs (38% and 40%, respectively), while only 14% graduated with an "A" average. This indicates, at least in pre-pandemic years, graduating high school with an "A" average in Maryland was not an easy thing to do and in fact, was a relatively rare occurrence. Compared to Michigan, for example, fewer Maryland high

school students graduated with an "A" average and more graduated with a "C" average.

The descriptive statistics alone make clear the powerful association between high school GPA and postsecondary outcomes. There is a clear trend toward higher postsecondary enrollment and degree attainment among students with higher high school GPA, but the relationship looks quite different for 2-year and 4-year programs. Compared to students with a "C" high school GPA, those with an "A" GPA were more than twice as likely to enroll in a 4-year institution and more than three times as likely to earn a bachelor's degree. In contrast, students with a "C" high school GPA were much more likely to enroll in a 2-year institution than "A" students, where both "A" and "C" students had low rates of associate degree attainment. While there could be some concern that the association between high school GPA and postsecondary education is heightened due to its requirements for postsecondary admissions in selective institutions, it does not explain the stronger association of High School GPA to postsecondary attainment than to postsecondary enrollment.

Almost all students with an "A" average (96%) enroll in postsecondary schooling and nearly 9 out of 10 of those who enroll earn some kind of postsecondary award. A large majority of "A' students (74%) enroll in four-year colleges and attain a bachelors degree (72%). For "B" students in high school, 87% enroll in postsecondary schooling and half (52%) earn a postsecondary degree, with 8% earning an associate degree, and 43% a bachelor's degree. Although "B" students are still more likely to enroll in a 4-year institution (52%) than a 2-year institution (35%), this difference is not as large as it is for "A" students.

While the power of an "A" average in high school for postsecondary success is clear, an equally powerful finding is the relative lack of postsecondary success for students finishing high school with a "C" average. Such students make up a large portion of Maryland high school graduates, and although a clear majority of that group (72%) enroll in a postsecondary institution of some kind, less than one-third ultimately earn any postsecondary award.

If we look at enrollments and attainment together, we see that GPA strongly differentiates postsecondary outcomes. Of the 14% of Maryland high school graduates who earned an "A" average in high school, more than three-quarters (79%) earn a postsecondary degree. Among the 38% of high school graduates with a "B" average, slightly more than half (52%) earn a postsecondary degree. Postsecondary degrees are relatively rare for the 40% of high school graduates with a "C" average, with less than one-third earning a certificate, associate degree, or bachelor's degree. Put another way, given how the K-12 and higher education systems are currently constructed, students who graduate high school with an "A" average are almost assured of getting a postsecondary degree, "B" students have a fighting chance, while high school graduates with a "C" average have fairly low odds of postsecondary success. Increasing the odds of postsecondary success seems to require better performance in high school courses.

Table 5 - Postsecondary Outcomes by High School GPA, MD Class of 2016 High School Graduates

HS GPA	% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor
"A"	14%	96%	22%	74%	79%	7%	72%
"B"	38%	87%	35%	52%	52%	8%	43%
"C"	40%	72%	41%	31%	29%	5%	23%

A deeper understanding of the high school experiences of students who graduate with "B" and "C" GPAs and earn postsecondary degrees is important because, at least in the years prior to the pandemic, these students represent nearly 80% of all high school graduates in Maryland. Even with much lower odds of post secondary success, high school students with a C average, in the class of 2016, for example, accounted for 25% of the BA degrees awarded to the class, compare to the 27% of BA degrees awarded to high school students with an A average. Nearly half (47%) of all the BA degrees earned by the class of 2016 were obtained by student who graduate high school with a B average.

Benefits of "B" and "C" students taking more challenging courses

For high school graduates with a "B" average, earning credits in advanced Math and Science courses seems to be related to stronger outcomes in terms of postsecondary awards, and 4-year degrees in particular (**Table 6**). For "B" students, taking Math courses beyond Algebra 2 and Science courses in Physics or Chemistry (particularly Physics) seem to provide additional benefit beyond GPA alone. For example, among "B" students who took a calculus course, 70% enrolled in college and earned a bachelor's degree, compared to 43% of all students with a "B" average. This indicates that it may be important, at least for some high school students' postsecondary success, that advanced math and science courses be open to "B" students and not just "A" students.

Table 6 - HS Grads with "B" average & Advanced Math/Science Credits

Highest Math/Science Course	% of All HS Graduates	4-year Enrollment	Any Award	Associate	Bachelor
Algebra 2	8%	35%	38%	10%	27%
Pre-Calculus	9%	60%	58%	7%	50%
Calculus or AP/IB Calculus	7%	81%	74%	3%	70%
No Physics or Chemistry	5%	38%	40%	7%	32%
Chemistry but no Physics	18%	50%	50%	9%	41%
Physics but no Chemistry	2%	54%	59%	6%	52%
Both Physics & Chemistry	13%	60%	58%	7%	50%

Some "C" students, also appear to benefit from taking advanced mathematics courses. Twenty percent of "C" students in the class of 2016, took pre-calculus and six percent took calculus. Only 24% of "C" students whose highest math class was Algebra 2, earned a postsecondary degree or credential, compared to 49% of "C" students who took pre-calculus and 66% of "C" students who took calculus.

Postsecondary Impact of "B" and "C" students taking AP courses

Maryland has been a leader in enabling a larger percent of high school students to take Advanced Placement (AP) courses. This can be seen in the fact that 43% of students in the Class of 2016 who graduated with a "C" average also took an AP class, as well as 71% of students who graduate high school with a "B" average. By comparison 90% of "A" students took an AP course. At each level of high school GPA, earning one or more AP/IB credits conferred benefits for postsecondary enrollment and award (**Table 7**), and this was more pronounced with a "B" or especially "C" average compared to an "A". For example, whereas the postsecondary enrollment gap between "A" students and "C" students was 27 percentage points among those who did not have any AP/IB credits, this dropped to 9 percentage points among those earning any AP/IB credits. However, AP/IB credits seem to have less power to compensate for a lower high school GPA in terms of earning a postsecondary degree: comparing "A" students to "C" students, there was a 36-point difference in earning a bachelor's degree among those without AP/IB credits, and a nearly identical 34-point difference among those with any AP/IB credits.

Table 7 – AP/IB Credits & Postsecondary Outcomes by High School GPA, MD Class of 2016 High School Graduates

High School GPA	Any AP/IB Credit	% within GPA Level	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor's
A	No	10%	87%	42%	45%	62%	17%	45%
	Yes	90%	98%	20%	78%	81%	5%	76%
B	No	29%	72%	46%	26%	29%	10%	18%
	Yes	71%	94%	30%	63%	61%	7%	53%
C	No	57%	60%	44%	16%	14%	5%	9%
	Yes	43%	89%	37%	52%	48%	6%	41%

Postsecondary Impact of Failing High School Courses

Taking more advanced courses seems to be one factor that increases the likelihood of "B" and "C" students earning postsecondary degrees. Another factor which substantially increases the **odds of postsecondary success for "B" and "C" high school students is not failing classes.**

High school course failure is fairly common in Maryland, with 35% of all high school graduates in our sample having at least one course failure.

Course failure, particularly in the ninth grade, has been shown to be a very strong predictor of dropping out of high school (Allensworth & Easton, 2007). For Maryland high school graduates, course failures in any grade of high school are also a significant predictor of postsecondary outcomes. Even a single course failure appears to significantly lower postsecondary outcomes, especially in terms of postsecondary completion and attainment. The 59% of high school graduates who did not fail any high school courses also did generally well in their courses overall, with an average GPA of 2.9 or a low B average. They also had comparably good postsecondary outcomes. **Ninety percent of high school graduates with no course failures enrolled in college, and 58% of them earned a postsecondary degree,** with 50% earning a bachelor's degree or higher, ten percentage points higher than the outcome for all students with a B average. This indicates that students with no course failures have a relatively good chance of earning a postsecondary degree.

Twelve percent of high school graduates failed just a single class, and they had a considerably lower average GPA (2.3, a C+ average) than those with no course failures. Fewer of them recorded any postsecondary enrollment (73%) than high school graduates with no course failures (90%). Most significantly, their success rate in college was much lower, with only 22% earning a postsecondary award, and just 15% earning a bachelor's or higher.

Fourteen percent of high school graduates failed two to four high school classes, with respective average GPAs from 2.0 to 1.7. **This group of students with two to four course failures represents 25 percent of Maryland's "C" students.** Among high school graduates who failed two to four high school courses, approximately 60 percent enrolled in postsecondary institutions, but only 11 percent went on to earn postsecondary awards.

Finally, a significant number of high school graduates, nine percent, failed five or more high school courses. Students can fail five or more courses and still graduate because the total credits needed for graduation are less than the total number of courses students can take over four years of high school. In Maryland, students who failed 5 or more courses, however, struggled with their courses more broadly, as their average GPA is 1.4 or C-/D+. **Forty percent of Maryland high school graduates with five or more course failures enroll in postsecondary but only 4% of them earn a postsecondary award.** While this is a low success rate, and it indicates that GPA combined with number of course failures is highly predictive of postsecondary success, it is important to remember that it is not determinative. A small number of high school graduates who struggle substantially in high school are able to succeed in college.

The Maryland data on course failures also might help explain why high school graduates with a "C" average have poorer postsecondary outcomes. Maryland high school graduates with a "C" average are not, in the main, getting Cs in all their classes. Rather, the majority (53%) of students with "C" averages have one or multiple course failures, which can signal less academic

motivation and/or substantial academic gaps and can undermine student self-belief in their academic potential. Indeed, in the absence of any course failures, students with a "C" average fare relatively well in terms of postsecondary outcomes, enrolling in and earning degrees from four-year institutions at a rate comparable to but slightly higher than the overall sample, and well above the rate of "B" students who had any course failures.

The strong association between the number of course failures and postsecondary outcomes also indicates that not only does doing well in high school courses substantially increase the odds of postsecondary success, but failing courses greatly decreases them. It also suggests that a more nuanced understanding of the predictive ability of GPA should include information about whether it is with or without course failures.

Table 8 - HS Course Failures & Postsecondary Outcomes, MD Class of 2016 High School Graduates

HS Course Failures	% of All HS Graduates	HS GPA	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor
0	65%	2.9	90%	32%	57%	58%	7%	50%
1	12%	2.3	73%	45%	27%	22%	6%	15%
2	7%	2.0	64%	47%	18%	13%	4%	8%
3	4%	1.9	58%	45%	13%	9%	3%	5%
4	3%	1.7	51%	42%	9%	7%	4%	3%
>=5	9%	1.4	40%	35%	6%	4%	2%	2%

What Can State Assessments Tell Us About Postsecondary Outcomes?

At the time that our sample graduated from high school, students in Maryland were required to have completed the Maryland High School Assessments (HSA) to demonstrate mastery in the following courses: Algebra I, English 10, and Biology. There were several ways for students to meet the requirements for a Maryland high school diploma with these exams, including earning a passing score on each, earning a combined score high enough to offset a below-passing score on one exam, or earning a high enough score on a related AP or IB exam. Because these state exams were intended to assess student mastery of course content, we examined the relationships between exam proficiency and postsecondary outcomes at various levels of overall high school GPA.

As shown in Table 9, there is a clear pattern of better postsecondary outcomes with stronger performance on either the Algebra or English HSA. Within each GPA category, students were more likely to enroll in a postsecondary institution and earn a postsecondary award with higher levels of proficiency on either the Algebra or English exam. The scale of this relationship varied with GPA, however. Among students with an "A" average, earning an advanced score on

an HSA conferred only a modest benefit over a proficient score, especially in terms of earning a bachelor's degree (nearly all "A" students recorded postsecondary enrollment regardless of assessment proficiency level). Among students with a "B" or "C" average, however, increasing proficiency scores on state assessments were strikingly associated with better postsecondary outcomes. For example, "C" students earning a score of Advanced on either HSA earned bachelor's degrees at twice the rate of "C" students earning a Proficient score, and ten times the rate of "C" students earning a Basic score.

GPA, however, still has strong impacts on postsecondary success, even after controlling for state assessments. This can clearly be seen in the attainment of bachelor's degrees. Among students who scored advanced on the Algebra assessment, 76% of those who earned an A GPA received a BA, compared to 64% of students with a B GPA, and 49% of students with C GPA. Results were similar for the English Assessment.

When GPA and state assessments are looked at together, it indicates that preparation for postsecondary degree attainment may have two components. One part, as captured by the HSA assessment, is about having sufficient academic skill and knowledge. It is also likely that AP taking courses indicates this as well. It is quite likely that the impact of scoring advanced on the HSA is in part picking up that such students continue to build academic skill and knowledge through AP course taking, given that over 80% of students in the class of 2016 who scored advanced on the HSA also took AP courses. Another key part of postsecondary preparation is picked up by GPA. It indicates a student's sustained ability to do coursework at a sufficient level, across different content areas and different instructors, while taking multiple courses at the same time, which is exactly what college students need to do to succeed. Just having a high level of academic knowledge and skill, in the foundational areas of math and English, is not enough. This can clearly be seen in the fact that A students with proficient scores on high school assessments have considerably stronger postsecondary outcomes than C students who score advanced.

At the same time, the level of competency obtained in math and English matters for postsecondary success. Differences in competency explain some of the reasons why students with a B average only have a 50/50 change of a postsecondary award and only 43% earn a BA. Thirty one percent of high school graduates with a B average scored advanced on algebra high school assessment. Among them, 69% earned a postsecondary award and 64% earned a BA. More than twice as many (64%) of high school graduates with a B average scored proficient on the algebra high school assessment. They had considerably worse postsecondary outcomes with 46% earning any award and 35% a BA. Results were similar for English. Equally strong impacts can be seen for high school graduates with C average. Sixty nine percent of the class of 2016 who graduated with a C GPA scored proficient on the math high school assessment, with 28% of these students earning a postsecondary award and 21% a BA.

Equal percents (15%) of high school graduates with a C average scored basic or advanced on the high school algebra assessment. Those who scored basic had postsecondary outcomes four times worse than those who scored proficient (with just 7% obtaining a postsecondary award), while those who scored advanced had outcomes twice as good with 55% earning a postsecondary award and 49% a B.A. Demonstrating a high level of academic competence by the 10th grade, however, does not off-set sustained academic success throughout high school. High School graduates with an A GPA who scored proficient on the algebra high school assessment had considerably better outcomes than C students who scored advanced, with 77% earning a postsecondary award and 68% a BA degree. At the same time, a B average paired with low test results (scoring basic on HSA) leads to poor postsecondary outcomes, with only 20% of such students earning a postsecondary award. In the class of 2016, very few "B" students scored basic, but their results further indicate that postsecondary success requires both a level of academic skill and knowledge and the combination of competencies needed to continually succeed in diverse and multiple courses over multiple years.

Table 9 – Postsecondary Outcomes by GPA and State Assessment Proficiency Levels, MD Class of 2016 High School Graduates

HS GPA	HSA Exam	Proficiency Level	N	Any PS Enrollment	Any PS Award	Bachelor's
"A"	Algebra	Basic	21	*	*	*
		Proficient	2893	96%	77%	68%
		Advanced	3973	97%	81%	76%
	English	Basic	20	*	*	*
		Proficient	2042	95%	75%	64%
		Advanced	4508	97%	82%	76%
"B"	Algebra	Basic	938	66%	20%	12%
		Proficient	12054	85%	46%	35%
		Advanced	5819	95%	69%	64%
	English	Basic	999	66%	19%	11%
		Proficient	10367	85%	43%	33%
		Advanced	6989	95%	67%	61%
"C"	Algebra	Basic	3052	49%	7%	4%
		Proficient	13478	74%	28%	21%
		Advanced	3036	90%	55%	49%
	English	Basic	3374	50%	7%	3%
		Proficient	11882	73%	27%	20%
		Advanced	4047	88%	52%	46%

* data suppressed due to low cell count

While substantially less frequent than among "A" and "B" students, a notable percentage of "C" students did go on to postsecondary success. To explore what distinguishes those students with successful postsecondary outcomes from those without, we focused on how several high school indicators relate to earning bachelor's degrees among "C" students. As seen in **Table 10,** graduating high school without having failed any courses was both the most frequently met indicator among "C" student who went on to earn a bachelor's degree, and the clearest

distinction between "C" students who earned or did not earn a bachelor's degree after enrolling in a 4-year institution. Even though these students may not have earned especially strong grades in high school on average, it seems that not earning any failing grades is significant for postsecondary success. The other indicators that we examined (earning at least one Math credit beyond Algebra 2, earning 1 or more AP/IB credits, and scoring Advanced on either the Algebra or English HSA) also distinguished between those who completed or did not complete a 4-year degree, particularly when considered in aggregate. Compared to "C" students who earned a bachelor's degree, those who enrolled in a 4-year institution but did not earn a bachelor's degree were nearly twice as likely to fall short of all of these indicators. "C" students who did not meet the high school indicators we examined were unlikely to enroll in a 4-year institution in the first place, and even less likely to earn a bachelor's degree once enrolled.

Table 10 – Frequency of Meeting Various High School Indicators among "C" Students

High School Indicator	% Meeting Indicator Among "C" Students Who…	
	Earned a Bachelor's Degree	Enrolled in a 4-Year Institution but Did Not Earn a Bachelor's Degree
Math credit beyond Algebra 2	74%	66%
1+ AP/IB credits	78%	58%
Advanced score on Algebra or English HSA	51%	34%
0 course failures	81%	55%
0 course failures and at least one other indicator listed above (advanced math credit, AP/IB credit, Advanced on HSA)	74%	48%
Not meeting any indicators among advanced math credit, AP/IB credit, and Advanced on HSA	10%	19%
1+ course failures and not meeting any indicators among advanced math credit, AP/IB credit, and Advanced on HSA	4%	13%

Using State Longitudinal Data Systems to Identify Key Indicators of Postsecondary Readiness

As we have seen, state longitudinal data systems can provide insight into which high school graduation requirements are more important in terms of postsecondary degree attainment. Potentially, they can also be used to identify high school outcomes which states, districts and schools can employ to provide guidance on where efforts to improve postsecondary readiness could be most impactful.

Good indicators have several key properties. They are reliable. They do better than chance in predicting who is likely to attain a postsecondary degree. They are valid. Educators, students, and parents can see how doing better on the indicator could translate into better success in college. They are malleable. Through improved educational practices, additional student supports, and/or shifts in student motivation, schools and students can influence the indicator. They are manageable and trackable. If there are too many indicators it will be more difficult for schools and students to keep track of them and act upon them. Finally, they have practical utility. Positive indicators which indicate students have stronger odds of obtaining a postsecondary degree should collectively identify students with better than a 2 in 3 chance (67%) of earning a degree. Negative indicators which indicate students have low odds of earning a postsecondary degree, should collectively identify students with less than a 1 in 3 (30%) chance of earning a degree. Positive and negative indicators should identify substantial portions of high school graduates who do and do not earn postsecondary degrees.

Identifying Positive Indicators of Postsecondary Readiness

As a baseline, we begin with current outcomes. For high school graduates from the class of 2016, 79% enrolled in postsecondary, 42% earned a postsecondary award, and 33% earned a bachelor's degree.

The first indicator we examine is perhaps the most widely known indicator of postsecondary readiness, having at least a B average GPA. Potentially, this indicator could have high utility in Maryland, given that 40% of the class of 2016 graduated with a C average, GPA. These students are more likely to be able to raise their average to B than to an A. Class of 2016 high school graduates who had a B average, GPA, had an 87% postsecondary enrollment rate, 52% earned any postsecondary award, and 43% earned a bachelor's degree.

This indicates that postsecondary success rates could well improve (by as much as 10 percentage points), if more students graduated with a B average GPA, than with a C average GPA. However, even with a B average GPA nearly as many students (48%) are not earning a postsecondary award, as those who are (52%).

In terms of sheer predictive power, nothing beats having an A average GPA. Class of 2016 high school graduates with an A average GPA, had a 96% postsecondary enrollment rate, 78% postsecondary award rate, and a 72% bachelor's degree rate. An A average GPA, however, falls short of being a good indicator due to issues with validity and malleability. If an indicator is currently obtained only by a small minority of high school graduates- only 14% of high school graduates in the class of 2026 had an "A" average - it can signal that a critical outcome like postsecondary success is only obtainable by a few. Moreover, it is not valid because the almost three-fourths of the high school graduates from the Class of 2016 who earned a Bachelor's degree did not have an A average high school GPA, only 27% did so.

Our best set of postsecondary readiness indicators emerged when we combine earning a B or A average GPA with taking at least one college level or college like course. Thirty-nine percent of high school graduates from the class of 2016 had a B or better GPA and took 1 or more Advance Placement (AP) course. Among them, 95% enrolled in postsecondary institutions, 67% earned a postsecondary award, and 60% earned a bachelor's degree. This set of indicators meets our key criteria. Currently 40% of high school graduates are obtaining them, showing that they are potentially obtainable by the majority of high school graduates. Fifty-seven percent of high school graduates from the class of 2016 took an AP course, indicating that where the most improvement is needed is moving some students from a C average to a B average and from B average to an A average.

This is the incremental improvement that schools have demonstrated the capacity to achieve. Why these outcomes matter can also be clearly communicated to teachers, students, and families. To succeed in college, you need to pass your courses, and to keep financial aid, you often need to maintain a B- average. Taking a college level or college like course in high school helps students get ready for differences in academic expectations and the level and type of academic work in college. Finally, combining a B or better GPA with taking a college level course in high school (and getting a B or better in it) indicates both the ability to master advanced academic skills and content and continually apply academic knowledge and skills along with the competencies needed to succeed in different courses with different instructors across multiple courses which are the high school outcomes students with the highest odds of earning a postsecondary degree have in common. It also meets our goal of identifying students who have at least a two in three chance of earning a postsecondary degree.

We then looked at the value added of including additional measures of advanced course taking. When we added in taking physics and chemistry and a math course beyond Algebra 2, we identify a group of high school graduates that had a 66% bachelor's degree attainment rate. However, while we increased the odds of earning a BA from 60% to 66% by adding in these measures of advanced course taking, it greatly reduced the percent of high school graduates obtaining these outcomes from 39% to 18%.

A word of caution in interpreting these results, based on additional analyses we have conducted with Maryland data and data from other states. While taking an AP course in Maryland is a better indicator of postsecondary success than advanced course taking in math and science, that is in good part driven by Maryland's decade plus long investment in spreading AP course taking widely. Three times as many Maryland high school graduates from the Class of 2016 took an AP Course than took Physics, Chemistry and math beyond algebra 2. If the percentages had been reversed, then advanced STEM course taking likely would have been a better indicator than AP courses. What stands out in the data from Maryland and other states, is the value of high school students taking one or more college level or college like courses, which could be AP, IB, Dual Enrollment or challenging honors level STEM courses.

The final indicator we examined was scoring advanced on the high school assessment for math or English. Scoring advanced on either the English or Algebra high school assessment (both aimed at the approximately the 9th/10th grade level) is achieved by 39% of high school graduates and they have postsecondary outcomes on par with high school graduates with a B or better average who take 1 or more AP courses, with 93% enrolling in postsecondary, 65% earning a postsecondary award, and 59% getting a B.A. degree. The weakness of using 10th grade test scores as a postsecondary indicator is that they are not as malleable as GPA or taking and doing well in advanced courses, at least during the high school years, as they only capture outcomes obtained in the first two years of high school. Moreover, at least in Maryland for the class of 2016, nearly all students who scored advanced on either the English or Algebra HSA also took one or more AP courses-and the exact same percent of high school graduates (39%) scored advanced on one of the high school assessments, as obtained a B or better average and took one or more AP class.

When we combine the indicator of scoring advanced on at least one high school assessment, with earning a B or better GPA and taking one or more AP courses, we get a set of postsecondary outcomes that are the most desirable. Ninety-seven percent of these high school graduates enrolled in postsecondary, three fourths (74%) obtained a postsecondary award, and more than two thirds (69%) earned a Bachelor's degree. These are the students that schools, the community, and parents can be confident are strongly prepared for postsecondary success. The challenge is this set of indicators was only achieved by 25% of high school graduates in the class of 2016.

Where this leads to is further evidence that strong high school preparation for postsecondary success, entails both a obtaining a relatively high level of academic skill and knowledge, at least in one academic domain, and the ability to continually succeed in a wide range of courses, taught by a range of instructors, while taking multiple courses at the same time. This indicates that a combination of a GPA of B or better plus no course failures, combined with some demonstration of advanced academic knowledge, skill and wherewithal, as seen by a high

score on a high school assessment, or success in an AP or other college level course provides the best operational set of postsecondary readiness indicators, that high schools as currently organized have the capacity to improve student outcomes on.

Table 11 – Key High School Indicators for Postsecondary Attainment, MD Class of 2016 High School Graduates

	% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor's
"B" or Better GPA	52%	90%	31%	58%	59%	7%	51%
≥ 1 AP/IB Credit	57%	93%	30%	62%	61%	6%	54%
≥ 1 AP/IB Credit + HS GPA ≥ "B"	39%	95%	27%	68%	67%	6%	60%
≥ 1 AP/IB Credit + HS GPA ≥ "B" + Physics & Chemistry Credits	19%	96%	24%	72%	71%	6%	65%
≥ 1 AP/IB Credit + HS GPA ≥ "B" + Physics & Chemistry Credits + Math Credit beyond Algebra 2	18%	96%	23%	74%	72%	5%	66%
Advanced on Either English or Algebra High School Assessment	39%	93%	26%	66%	65%	6%	59%
Advanced on Either English or Algebra HSA + HS GPA ≥ "B"	28%	95%	24%	71%	72%	6%	65%
1 AP +, HS GPA B or Better, Advanced on English or Algebra HSA	25%	97%	21%	76%	74%	5%	69%

Confirming the positive postsecondary indicators

The fact that 67% of high school graduates in the class of 2016, who earned a postsecondary award, shared a common set of high school outcomes, does not in itself indicate that increasing the number of students with these outcomes, would improve postsecondary success rates. It is possible that these students shared other characteristics, which are the actual drivers of the greater postsecondary outcomes they achieve.

To account for this possibility, we used propensity score matching to compare students who reached those high school benchmarks to students who did not but who were otherwise very similar, based on their demographic backgrounds and GPA from their earliest year of high school on record. This enables us to derive causal evidence and an estimate of the indicators' impact on students' postsecondary achievements.

Controlling for background characteristics and prior achievement, logistic regression analysis indicates that completing high school with at least one AP credit and a GPA of B or higher were the strongest predictors of postsecondary success. High school graduates who took one or more AP courses were more than three times as likely to enroll in any postsecondary institution, and more than twice as likely to enroll in a four-year IHE, and to earn a bachelor's degree, against a group of similarly matched students. A high school GPA of "B" or higher was also strongly predictive, particularly of earning a bachelor's degree, with such students being more than three times as likely to earn a bachelor's degree. The other factors highlighted in Table 11 above showed significant but more modest relationships with postsecondary outcomes. Compared to similarly matched students, those who earned credits in both chemistry and physics were twice as likely to record any postsecondary enrollment, nearly twice as likely to enroll in a four-year IHE, and 1.5 times as likely to earn a bachelor's degree. Similarly, students who earned a math credit beyond Algebra II were 1.5 times as likely to record any postsecondary enrollment, twice as likely to enroll in a four-year IHE, and 1.5 times as likely to earn a bachelor's degree. Students who scored Advanced on either the English or Algebra HSA were nearly twice as likely to enroll in any postsecondary institution, and slightly more likely to enroll in a four-year institution, but an Advanced HSA score was not a significant predictor of earning a bachelor's degree.

This analysis, increases our confidence that it is the experience and impact of earning a B or better GPA in high school along with taking and doing well in a college-level or college-like course that increases a high school graduate's odds of postsecondary success, rather than some other characteristics of the students who obtain these high school outcomes. One final caveat about predictors of postsecondary success; as predictors, they indicate students with strong odds of achieving postsecondary success that have much higher odds than high school graduates without the indicators. They are not, however, determinative. In the class of 2016, about 14% of students who did not achieve a B average in high school, take any advanced math or AP courses, or score advanced on the Algebra or English high school assessment still went on to earn a postsecondary award.

Identifying Negative Indicators of Postsecondary Readiness

Our analysis identifies one clear set of indicators that high school graduates may not be ready for postsecondary success. It is graduating with a C average and having one or more course failures. Twenty-nine percent of high school graduates in the Class of 2016 had these

indicators. The majority did not pursue higher education at least within the two years of graduating high school, with 43% enrolling in a postsecondary institution. Nearly all of those who did enroll, enrolled in a community college at some point (6100 of the 6300). Only 8% of the high school graduates with a "C" average and one or more course failures who enrolled in a community college ultimately earned an associate's degree (n=489). Fourteen percent of these high school graduates enrolled in a 4-year college (2048) with 45% (n=921) earning a B.A. degree. Overall, only ten percent of high school graduates who have a "C" average and have failed one or more courses earn a postsecondary award.

Propensity matching and logistic regression analysis confirms that controlling for demographics and early high school GPA, graduating high school with a "C" average and one or more course failures is a very strong indicator of insufficient postsecondary readiness. Compared to similarly matched peers, "C" students who recorded any course failures were approximately half as likely to enroll in a four-year institution, and one-third as likely to earn a bachelor's degree. Like all indicators, it is not determinative; about 1 out of 20 of these graduates were able to earn a B.A. degree. Perhaps because life events impacting their high school success shifted, or the change in school environment from high school to college enabled greater motivation to succeed in school. This seemed more likely to occur for students who ultimately attended four year institutions, with a greater number of high school graduates with a C average and one or more course failure graduating with a B.A. rather than an AA degree (921 vs 489).

Who Has Access to the Courses, Outcomes, and Advantages that Seem to Matter for Postsecondary Attainment?

The Role of Family Income

In **Table 12** we first examine the general relationship between a high school graduate's economic status and their postsecondary outcomes, with economic status for Maryland students defined by eligibility for the federal Free/Reduced Price Meals program. As many other studies have found, the differences between economically advantaged and disadvantaged students are quite substantial in terms of postsecondary enrollment, particularly in four-year institutions, with economically advantaged students twice as likely to enroll as economically disadvantaged students. However, the biggest impact of economic advantage is on postsecondary attainment, with a 27-point gap in the percentage of students earning a postsecondary award of any kind, and more than twice as many economically advantaged as disadvantaged students earning a bachelor's degree. Given that nearly a third of the high school graduates in Maryland are economically disadvantaged, a key question is how much of this gap is related to factors beyond high school preparation, like the cost of

postsecondary schooling, and how much is related to differences in the opportunities and supports which enable high school graduates to achieve the high school outcomes most associated with postsecondary success?

Table 12 – PS Outcomes for Economically Advantaged and Disadvantaged HS Grads, MD Class of 2016 High School Graduates

	% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor's
Economically Advantaged	70%	85%	34%	50%	51%	7%	43%
Economically Disadvantaged	30%	66%	39%	27%	24%	5%	17%

Table 13 shows the postsecondary outcomes of students broken out by both their economic status as well as by their high school GPA. It indicates that the economic status of high school graduates and their high school course performance have additive impacts on their postsecondary attainments. Both economically advantaged and disadvantaged students who graduate high school with "C" averages have lower postsecondary outcomes than their counterparts with higher GPAs. "C" average high school graduates who are economically disadvantaged are much more likely to also fail one or more high school courses (54%) than "C" average high school graduates who are economically advantaged (27%). Thus, they are about twice as likely to have the strongest negative indicator of postsecondary success as their more economically advantaged peers. The challenges of being economically disadvantaged, can also follow students into college, including being a factor in their higher enrollment in two-year institutions, which tend to have low attainment outcomes for "C" students. The significantly smaller percent of "C" students from economically advantaged backgrounds who also failed one of more courses in high school combined with, on average, fewer financial challenges in college and higher enrollments in four-year vs two-year institutions likely all play a role in the significantly better postsecondary attainments for economically advantage "C" students, with 29% earning a Bachelor's Degree versus 11% of "C" students from economically disadvantaged families.

Graduating high school with an "A" average appears to off set some of the negative impacts of family income on postsecondary success. Nearly all high school graduates with an "A" average enroll in a postsecondary institution regardless of family income level, with 97% of economically advantaged and 93% of economically disadvantaged students enrolling. **Seventy-one percent of economically disadvantaged high school graduates with an "A" average obtain a postsecondary degree.** This is nearly thirty percentage points higher than the outcome for all high school graduates. Moreover, 61 percent of all economically disadvantaged high school students with an "A" average earn a bachelor's degree, a rate nearly six times greater than that of economically disadvantaged graduates with a "C" average. Family income though, still

has an impact on the postsecondary success of high school graduates with an "A" average, as economically advantaged "A" students have overall degree attainment rates 10 percentage points higher, and BA attainment rates 13 percentage points higher. It is worth noting though, that economically disadvantaged high school graduates with an "A" average outperform economically advantaged graduates with a "B" average, with a bachelor's attainment rate that is 13 percentage points higher.

This indicates that the large overall postsecondary attainment differences observed between economically advantaged and disadvantaged are primarily driven by differences in the rates at which they receive the opportunities and supports needed to do well in their high school courses (and avoid course failure), as well as take more advanced courses. Seventeen percent of economically advantaged high school graduates were able to attain "A" averages, compared to six percent of economically disadvantaged students, while "C" averages were more common among economically disadvantaged (48%) than economically advantaged high school graduates (36%). The combination of lower grades and economic disadvantage, moreover, also seems to direct more economically disadvantaged high school graduates to enroll in two-year institutions, which overall have lower graduation rates, than four-year institutions.

Table 13 – PS Outcomes by Economic Status and HS GPA, MD Class of 2016 High School Graduates

	HS GPA	% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor
Economically Advantaged	"C"	25%	78%	41%	38%	36%	6%	29%
	"B"	29%	90%	33%	56%	57%	8%	48%
	"A"	12%	97%	21%	76%	81%	6%	74%
Economically Disadvantaged	"C"	14%	63%	43%	20%	16%	4%	11%
	"B"	9%	80%	39%	41%	36%	8%	27%
	"A"	2%	93%	28%	65%	71%	9%	61%

As seen in **Table 14**, we find a similar pattern when we look at the outcomes of economically advantaged and disadvantaged high school graduates who obtain the full set of indicators we have identified as being predictive of postsecondary success (1 or more AP/IB credits, HS GPA of "B" or higher, credits in both chemistry and physics, and math credit beyond Algebra 2). Having the opportunity and support to achieve the key high school indicators helps economically disadvantaged students substantially. Whereas only 11% of economically disadvantaged high school graduates with a "C" average earn a bachelor's degree and 16% any postsecondary award, 50% of economically disadvantaged high school graduates who obtain the key indicators of postsecondary success earn a bachelor's degree and 59% any

postsecondary award. **Moving from just passing courses to strong preparation is associated with a nearly 5 times increase in bachelor's degree attainment for economically disadvantaged high school graduates.**

While a relatively high percent of economically disadvantaged students with key indicators obtains postsecondary degrees, an even greater percentage of economically advantaged students do so. **This suggests that even with similarly high levels of high school preparedness and postsecondary enrollment, there are advantages associated with greater family income that increase postsecondary attainment.** Sixty-nine percent of economically advantaged high school graduates who obtained our key indicators of postsecondary success earned a bachelor's degree, and 74% any postsecondary awards. These rates are respectively 19 and 15 percentage points higher than economically disadvantaged students who obtained our key indicators. In addition, advantages flowed to economically advantaged students through their greater opportunity to achieve the key indicators of postsecondary success, with roughly 2.5 times as many having the opportunity and supports to do so.

Table 14 – PS Outcomes by Economic Status for Students with Key Indicators, MD Class of 2016 High School Graduates

	% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor
Economically Advantaged	15%	97%	22%	75%	74%	5%	69%
Economically Disadvantaged	2%	94%	30%	64%	59%	8%	50%

To further explore how demonstrating strong preparedness in high school may mitigate the economic advantage gap in postsecondary outcomes, we also examined the effects of the specific indicators that most strongly related to postsecondary outcomes overall (GPA, AP/IB credits, and HSA proficiency). **Table 15** compares the postsecondary outcomes of economically advantaged and economically disadvantaged students, focusing only on those who recorded a "B" or better high school GPA and either earned 1 or more AP/IB credits or scored Advanced on at least one HSA. Meeting these indicators confers similar benefits to economically disadvantaged students as the earlier, more extensive, set of indicators, particularly in terms of enrollment: an overwhelming majority of these economically disadvantaged students recorded any postsecondary enrollment, and the economic advantage gap in 4-year postsecondary enrollment shrinks to 15 percentage points, compared to a 23-point difference in the full analytic sample. Similarly, among students meeting these indicators, the economic advantage gap in bachelor's degree attainment is 20 percentage points, compared to 25 points in the full sample. Thus, these selected indicators may partially mitigate the poorer postsecondary outcomes generally associated with economic disadvantages, but economically disadvantaged students were far less likely to meet them, with 25% doing so (compared to 50% of economically advantaged students).

Table 15 – PS Outcomes by Economic Status for Students with Selected Indicators, MD Class of 2016 High School Graduates

	% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor
Economically Advantaged	35%	95%	27%	68%	69%	7%	62%
Economically Disadvantaged	8%	90%	36%	53%	51%	9%	42%

Family Income, Race, and Ethnicity

Table 16 looks at the intersection of high school outcomes, economic status, and race. **When Black and non-Black high school graduates are both economically advantaged and have an "A" average, postsecondary outcomes are high and racial gaps almost non-existent, with 74% of Black students and 75% of non-Black students earning a bachelor's degree. Relatively few Black high school graduates in Maryland, however, fall into both these categories:** 50.2% of all Black high school graduates in our sample came from economically advantaged backgrounds, compared to 81.3% of non-Black students. Overall, 11% of high school graduates had an A average and were economically advantaged. Nine percent of those students were black. Thus, economically advantaged Black graduates with "A" averages in high school represented 1% of all high school graduates (while Black students overall accounted for 32.6% of all high school graduates in our sample).

Table 16 – PS Outcomes by Race for Economically Advantaged Students with HS GPA of "A", MD Class of 2016 High School Graduates

	% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor's
Non-Black	10%	97%	21%	76%	81%	6%	75%
Black	1%	97%	16%	81%	78%	3%	74%

Where the intersection of family income and race have the most pronounced impacts is with economically disadvantaged students. Overall, Black economically disadvantaged high school graduates seldom received the opportunities and supports needed to obtain key indicators of postsecondary success. Only 6.2% of economically disadvantaged Black high school graduates had achieved the set of key indicators (1 or more AP/IB credits, HS GPA of "B" or higher, credits in both chemistry and physics, and math credit beyond Algebra 2), as compared to 17.6% of all high school graduates.

Similarly, as seen in **Table 17**, when students met the set of indicators most influential in postsecondary outcomes (GPA, AP/IB credit, and Advanced HSA score), there were relatively small differences in postsecondary enrollment between Black and non-Black students regardless of economic advantage or disadvantage.

Compared to non-Black students in the same economic advantage category, Black students were slightly more likely to enroll in a postsecondary institution, particularly a 4-year one. A different pattern emerges in degree attainment among this group of highly prepared students, though. Whereas nearly all of the non-Black highly prepared students who enrolled in 4-year institutions later earned a bachelor's degree, about a quarter of Black highly prepared students who enrolled in 4-year institutions did not earn a bachelor's degree (within seven years of high school graduation). Regardless of race, economic advantage played a clear role in postsecondary outcomes: Economically advantaged students were more likely to enroll in a 4-year institution, and then more likely to earn a bachelor's degree after enrolling. Even among this subset of students who met key indicators strongly related to postsecondary success, students benefited from family economic advantage, as only half of the economically disadvantage, highly prepared students both Black and non-Black earned post-secondary awards.

Table 17 – PS Outcomes by Race and Economic Advantage for Students Meeting Selected Indicators, MD Class of 2016 High School Graduates

		% of All HS Graduates	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor's
Economically Advantaged	Non-Black	29%	95%	27%	67%	71%	7%	64%
	Black	6%	96%	22%	74%	59%	4%	54%
Economically Disadvantaged	Non-Black	4%	87%	44%	43%	52%	11%	40%
	Black	3%	93%	27%	66%	50%	6%	43%

Variation across School Districts in postsecondary outcomes and postsecondary readiness indicators

Another factor which can influence high school graduate's postsecondary outcomes and readiness is the district in which they attend high school. School districts in Maryland, like in many states, can add graduation requirements to state minimums. They can also vary in the level and types of opportunities and supports they provide their students. In addition, districts vary in the number and percent of students they educate from different income levels and backgrounds. Maryland has relatively few districts (24 regular local school systems), but there is considerable variability in the demographic composition and postsecondary outcomes among these districts.

The school districts with the highest postsecondary outcomes for the Class of 2016 were almost entirely lower-poverty and lower-minority, while the districts with lowest postsecondary outcomes were distinctly higher-poverty and higher-minority. In **Table 18** we select and highlight a small sample of school districts that underscores the characteristics of school districts which had the highest and lowest postsecondary outcomes. The districts categorized as higher-poverty higher-minority had student populations that were in the top quartile of both non-White students and economically disadvantaged students, as of 2016,

and the lower-poverty lower-minority districts were in the bottom quartile on both of these characteristics. This resulted in three districts in each of the categories.

High School Graduation and Postsecondary Outcomes

The first difference between the two sets of districts is their high school graduation rates. In the lower-poverty lower-minority districts, nearly all their high school students (95 percent or more) graduated from high school. In contrast, about three-quarters of the high school students in the higher-poverty higher-minority districts graduated high school, including 5th and 6th year graduates.

Table 18 – PS Outcomes in Selected High-poverty-High-minority vs. Low-poverty-Low-minority School Districts, High School Graduates Class of 2016[7]

	N	Average 2016 HS Grad Rate	Any PS Enrollment	2-year Enrollment	4-year Enrollment	Any Award	Associate	Bachelor's
High-poverty High-minority Districts	9,567	78%	69%	33%	36%	26%	4%	22%
Low-poverty Low-minority Districts	3,633	>95%	80%	38%	41%	48%	7%	39%

Table 18 shows the postsecondary outcomes for these two sets of districts. More than two thirds (69%) of the high school graduates from the high-poverty, high-minority districts enrolled in college, but just a quarter (26%) of high school graduates in these districts earned any postsecondary award and only about one in five high school graduates earned a BA degree.

The postsecondary outcomes are quite different for the high school graduates from the low-poverty, low-minority districts. The vast majority (80%) of the high school graduates from these districts enroll in college. Nearly twice as many (48% to 26%) earned postsecondary degrees and just about four in ten earned Bachelor's degrees.

There are several important findings to highlight in these outcomes. We have observed that across the state, there is an income effect on postsecondary success, with students from more economically advantaged families obtaining higher postsecondary outcomes than similar students from more economically disadvantaged families, in part because the cost of higher education is substantial. The difference between the districts with the highest and lowest postsecondary outcomes, however, are greater than outcomes between individual students form different income levels. This suggests that there could be additional challenges to

[6] Each group of districts includes 3 school districts. For High-poverty districts, total student enrollment in the 2015-16 school year was much smaller or much larger than the state median of around 17,000 and ranged from 2,9098 to 128,936. For Low-poverty districts, total student enrollment in the 2015-16 school year tended closer to the state median, ranging from 7,717 to 25,551.

postsecondary success when students attend high school in districts with high percentages of low-income students.

Another key finding is that high school graduates from the districts with the highest postsecondary outcomes, are still only achieving modest postsecondary outcomes. In these districts nearly every student graduate and a vast majority (80%) enroll in college. However, less than half the graduates in these districts earn a postsecondary award and less than 40% a BA degree. Thus, living in a district of relative affluence, where everyone graduates high school, and nearly everyone goes to college, does not in itself lead to high postsecondary outcomes.

Postsecondary Readiness Indicators

Another difference between the districts with higher and lower postsecondary outcomes could lie in the extent to which they are able to provide their students with the supports and opportunities to achieve the high school outcomes linked to postsecondary success. When comparing the two sets of districts on key indicators of postsecondary readiness, as seen in **Table 19**, some important similarities emerge.

In terms of the opportunity to take advanced courses, the districts with the highest and lowest postsecondary outcomes, with one exception, are both providing significant numbers of their high school graduates with this opportunity. In general, the results for advanced course taking are higher than what is found in many other states, particularly for AP course taking, indicating that across the state, regardless of the demographic and family income characteristics of their students, districts have been able to widely spread access to AP courses and other advanced courses to their high school graduates.

High School graduates from districts with the highest postsecondary outcomes, by and large, are taking AP classes (63%), enrolling in physics and chemistry (69%), and earning math credits beyond Algebra 2 (56%). They are earning two foreign language credits (74%), a requirement for the state public flagship school, University of Maryland at College Park.

On two of the advanced course taking outcomes, the higher poverty, higher minority districts did even better than the high school graduates from districts with higher postsecondary outcomes, with 60% of high school graduates taking a math course beyond Algebra 2 (four percentage points higher), and 82% earning two foreign language credits (8 percentage points higher). Forty-one percent of the high school graduates in the higher poverty, higher minority districts took an AP class. This is 22 two percentage points lower than in the lower poverty, lower minority school districts, but still represents a relative high level of AP course taking. It is only in terms of advanced science course, that a very large difference emerges with only 27% of the high school graduates from the higher poverty, higher minority school districts taking physics and chemistry compared 69% in of high school graduates in the lower poverty, lower

minority districts (a 42-percentage point difference).

Where there is a stark contrast in having the support and opportunities to achieve postsecondary success indicators between high school graduates in the higher and lower postsecondary outcome districts is with GPA. We have seen that high school graduates with an A average GPA, almost always earn postsecondary degrees. Only eight percent of the high school graduate in the districts with lower postsecondary outcomes achieve this outcome compared to a state average of 14%. By contrast 26 percent of high school graduates in districts with higher postsecondary outcomes achieve an A average GPA. This is nearly double the state average, and three times higher than in the lower postsecondary outcome districts. We have also seen, that unless it is offset with strong outcomes on high school assessments, high school students with C averages have relatively low odds of obtaining postsecondary degrees. Twenty-two percent of the high school graduates from the higher postsecondary outcome districts had a C average GPA, compared to 41% of the graduates in the lower postsecondary outcomes. Finally, we have identified graduating with a C average and one or more course failures as an indicator of low postsecondary readiness. Thirty-seven percent of high school graduates in the districts with lower postsecondary outcomes have this indicator compared to 15% percent of the graduates from higher postsecondary success districts. Thus, more than one third of the high school graduates in the higher poverty, higher minority school districts and twice as many, as found in the lower poverty, lower minority school districts, are not receiving the supports and opportunities to graduate with even modest odds of postsecondary success.

Table 19 – Postsecondary Success Indicators Among High School Graduates, Class of 2016 from Selected High-poverty-High-minority vs. Low-poverty-Low-minority School Districts

	% of HS Grads with HS GPA of "A"	% of HS Grads with HS GPA of "B"	% of HS Grads with HS GPA of "C"	% of HS Grads with 1+ Course Failures	% of HS Grads with at least one AP/IB credit	% of HS Grads with Chemistry and Physics Credits	% of HS Grads with Math credit beyond Algebra 2	% HS Grads with at least 2 foreign language credits
High-poverty High-minority Districts	8%	37%	41%	54%	41%	27%	60%	82%
Low-poverty Low-minority Districts	26%	49%	22%	24%	63%	67%	56%	74%

Thus, the district a student attends high school in plays a role in their odds of postsecondary success. In some more than others, the combination of greater family financial resources, the capacity and resources of the schools to provide the supports and opportunities students need to obtain key postsecondary success outcomes, and potential peer effects (attending school with more or less students obtaining these indicators) result in more students graduating with strong odds of postsecondary success. The most notable differences between the school districts in Maryland with the highest and lowest rates of postsecondary success is that the lower poverty, lower minority school districts who have the highest postsecondary outcomes are better positioned to enable more students to graduate with an "A" average, and fewer graduate with a "C" average. Most significantly of all, they have half as many students who graduate with the a "C" average and one or more course failures, which is the strongest predictor of negative postsecondary outcomes. In addition, many more of their graduates are taking both Physics and Chemistry.

It is also important to note that high poverty, high minority districts in Maryland, have found ways to provide the supports and resources needed for high percentages of their graduates to take an AP/IB course, a math class beyond Algebra 2 and two years of a foreign language. This indicates, that while it makes it more challenging, serving a high concentration of students with lower family financial resources, does not preclude providing high school students with supports and opportunities to obtain key postsecondary success indicators. At the same time, having fewer students facing the challenges of low family income or poverty, and the accrued disadvantages of minority status, does not lead in itself to high rates of postsecondary success for all students. The lower poverty, lower minority districts with the best postsecondary results in Maryland for the class of 2016, had only middling outcomes with slightly less than half their high school graduates earning a postsecondary degree or certificate.

A final factor to consider is that Maryland, compared to some other states, has relatively few school districts (24). This results in larger districts with more variety of circumstances within them. Michigan, for example, has over 300 much smaller school districts, with each small city, town or rural area having their own school system. Thus, it is likely that the greatest disparities in high school student's ability to receive the supports and opportunities to graduate high school with high odds of postsecondary degree attainment in Maryland will be found at the school/neighborhood level, not the district level.

Using Maryland's State Longitudinal Data System to Help Determine High School Graduation Requirements and Preparation for College Success

The traditional means through which we have established high school graduation requirements, through informed, expert viewpoints has merit. The educators who interact with high school and college students in an on-going basis, as they work to build their skills, knowledge, and academic dispositions have valuable and unique perspective on what is required to prepare students and say they are prepared for postsecondary success. Our analysis of the empirical relationship between high school credits, courses taken, grades, and high school assessments, and college enrollment, performance, and degree attainment, based on data provided by the Maryland SLDC, for high school graduates from the Class of 2016, shows that expert opinion can be fine-tuned through empirical analysis.

Prior to the emergence of SLDS, the main way high school experiences and outcomes could be associated with postsecondary outcomes, was by using the national surveys which have been periodically fielded by the US Department of Education based on representative samples of students. These surveys, however, could only follow one cohort of students i.e. 9th graders in 2009. Nor did they enable state-level analysis which is essential to test the utility of the different graduation requirements that different states set. The advantage of SLDS's is that you can examine cohorts of all high school graduates at the state level. This results in data sets with tens to hundreds of thousands of students, enabling fine-grain analysis of sub-groups differentiated by family income, ethnicity, gender, and school district attended on a wide range of high school and postsecondary outcomes. The disadvantage is that despite substantial federal investments, not all states have yet developed SLDS's which enable high school and college transcripts to be linked at the individual level. As a result, not all states can yet conduct the analysis conducted for this report on Maryland. What we have found for Maryland, and in a similar analysis done with Michigan SLDS data, however, can be used to deepen our understanding of which high school outcomes, at least in two states, matter most for postsecondary success. It also serves as a model of the value other states could derive by using their state longitudinal data systems to conduct similar analysis, and where necessary improving them to enable it.

Key Findings

Our analysis of the postsecondary outcomes of high school graduates from the Class of 2016, indicates that conventional wisdom and some established practices may need to be updated. In other cases, it confirms for Maryland what prior national studies have shown.

More credits is not better: There is not a direct relationship between total credits earned in high school and postsecondary attainment. High school graduates who earned the 21 credits Maryland requires for graduation, including a solid core of 14 academic credits, 4 English, 4 math, 3 science and 3 social studies, had postsecondary outcomes just as strong, as students who earned 24 or more credits. This is significant, as a number of states in the 2010's increased the number of high school credits required to earn a diploma to 24 based on the belief that requiring students to earn more academic credits in high school would better prepare them for college. Given that a typical high school student takes 6 credits per year and 24 over four years of high school, this leaves almost no room in high school students schedule for internships, workplace learning, or other forms of experiential or deeper learning. It also leads to an hour after hour, day after day, year after year, sameness to the high school experience, which may be a contributing factor to high rates of disengagement and chronic absenteeism among high school students.

We found similar results among Michigan high school graduates. At least in these two states, the finding that more credits is not better, indicates that once a student takes a core set of academic classes, requiring them to take additional academic courses on the theory that it better prepares them for college success is not supported by actual postsecondary outcomes. It also indicates that there could be considerable room in the high school schedule, without compromising college-readiness, for more project-based, competency-based, workplace and other real- world learning opportunities that are not tied to traditional seat time credits or grades. This suggests that California's approach of working with its higher-education institutions to identify 14 core academic course aligned with postsecondary readiness, it's A-G courses, for which standards and syllabuses were also developed, an outlier approach in the 2010's, may be more accurately aligned with insuring students are prepared for college, than the more academic credits is better approach adopted by other states.

Algebra 2 is not what it once was in terms of signaling strong odds of postsecondary success. Based on research done in the 1990's which showed that high school students who took Algebra 2 had higher odds of postsecondary success, many states in the '00's moved to require math through Algebra 2 as a graduation requirement or to encourage most students to take it. This was the case in both Maryland and Michigan and by the mid 2010's, most high school students were taking Algebra 2. Ninety two percent of the high school graduates in Maryland's class of 2016 took Algebra 2. The Maryland and Michigan SLDS data, however, shows that

once taking a math course through Algebra 2 became the norm, it was no longer associated with high odds of earning a BA degree. The postsecondary success odds once associated with Algebra 2, are now associated with taking more advanced math classes, such as pre-calculus, Calculus or AP math courses. This indicates that the association between advanced math classes and postsecondary success, is likely the result of identifying the students who have a high facility for mathematics learning, as it is constructed in their high school, as well as students who are self-selecting to take a higher-level math class than required for high school graduation. This, in turn, may capture the high school students who graduate with the combination of capacity, interest, self-belief, and motivation to do well in math or math-based courses in college, which increases their ability to succeed in college and hence earn postsecondary degrees.

The same may be true for advanced science classes. High school graduates in Maryland who took science through Chemistry and Physics had higher BA degree attainment rates. The advantage for advanced math and science courses also held for students who graduated with a "B" average. This both suggests, that being good at math and/or science in high school is beneficial in terms of postsecondary success, and that opportunities to achieve this should not be limited to only "A" students.

Taking college level courses in high school increases the odds of postsecondary success. With all else being equal, high school graduates in Maryland who took an AP course had greater odds of attaining postsecondary degrees. The greatest impact was seen between high school graduates who took a single college level course in high school, and those who did not take any. There were incremental benefits to taking additional AP classes but diminishing returns as more courses are taken. This suggests, that much of the impact of taking a college level course in high school may be in the experience it provides students with the demands and expectations of college level work. It is worth noting that, on average, significant benefits were seen for students who earned high school credits and got A's or B's in college level classes, whether or not they officially earned college credit for the course, for example, by having a high enough score on an AP exam.

Some courses that do not appear to increase postsecondary outcomes might still matter because they teach important life skills or open up labor market opportunities. A case in point is computer science. We found no relationship between high school graduates in Maryland (or Michigan) in taking one or more computer science courses and postsecondary degree attainment. Students who did and did not take computer science, all else being equal, succeeded in postsecondary institutions at similar rates. Though we were not able to examine it, it is possible that taking computer science courses in high school is associated with taking STEM majors in college, which could result in higher labor market earnings, for all students or students from historically underserved populations in STEM majors and fields. It is also

possible that some basic knowledge of computer science is important to becoming an informed citizen. The findings of no relationship between taking computer science courses and earning a college degree, however, is important in that it indicates that the benefits, if they exist, are more indirect than direct. Thus, the value of requiring computer science of all high school graduates, as some states are doing, may need to be expressed as an important life skill or opening up labor market opportunities, rather than college preparation.

High school grades matter and matter most when combined with taking challenging courses. To succeed in college, you need to get decent grades in challenging courses. In many higher education institutions, maintaining a "B" average for example, is required to keep various forms of financial aid. In addition, students who fail courses fall behind earning the credits they need to graduate, and are required to stay in college longer, increasing its costs and the likelihood that life events will interfere. In Maryland's Class of 2016, only 14% of high school graduates earned an A average and 79% of them earned college degrees. 38% of high school graduates had a "B" average and 52% earned college degrees. A nearly equal number of students (40%) graduated with a 'C" average but only 29% earned a college degree. The success of "B" and "C" students, however, improves considerable when they have taken advanced math and science courses. An equal number of "B" average high school graduates, for example, had Algebra 2 and Calculus as their highest math credit. But almost twice as many (74% vs 38%) of the "B" average students who had Calculus as their highest math credit earned college degrees than "B" average students who stopped at Algebra 2.

Failing classes in high school greatly decreases the odds of postsecondary success. A little more than one-third (35%) of Maryland's high school graduates from the class of 2016, failed one or more course in high school. This had a strong impact on their postsecondary success. Among the 65% of high school graduates who did not fail a high school course, 50% earned a BA degree. This is three times better than that the outcome for high school graduates who failed one or more courses, as only 15% of them earned BA degrees. One of the primary reasons for the low postsecondary outcomes for Maryland high school graduates with a "C" average, is that half of them (53%) failed one or more high school courses schools. Twenty-nine percent of Maryland's high school graduates had a "C" average with one or more course failures. Only 10% of them earned a college degree. High school graduates with a "C" average and no course failures have better postsecondary outcomes than "B" average students who failed one or more courses. This indicates that course failure, which has primarily been seen as a strong factor behind dropping out of high school, plays an equally powerful role in dramatically lowering the odds of postsecondary success, among student who graduate from high school.

Scoring better than proficient (advanced) on high school assessments increases the odds of postsecondary success, but other metrics of academic skill can provide equivalent outcomes. High school graduates in the class of 2016, who scored advanced on either their Algebra or English high school assessments had greater odds of postsecondary success than high school graduates who scored proficient on both assessments. In 2016, nearly all high school graduates scored proficient or better on the Algebra and English school assessments, because such scores with some exceptions, were required to earn a diploma. High School graduates who scored proficient on both assessments and also either took an AP course or advanced math and science course, however, had postsecondary outcomes surpassing those of high school graduates who scored advanced on one or both high school assessments but did not take college level or advanced math and science courses in high school. This suggests that higher levels of academic skill and knowledge leave students better prepared for postsecondary success, but that there are multiple ways to achieve and demonstrate this. This finding, moreover, provides support for the intent behind the Maryland Board of Education's 2025 revisions to the state's college and career readiness standards, which was to provides multiple ways for students to demonstrate their readiness. Further research in partnership with the MLDS Centre can help establish which of the multiple ways are most beneficial for both college and workplace outcomes.

The best indicators that a student has good odds of postsecondary success combine metrics of academic knowledge and skill and academic success behaviors. Students need a sufficient level of academic knowledge and skills to do well in their courses. They also need the set of academic behaviors required to get decent grades, in multiple subjects, across different instructors, taking multiple courses at a time. This combination of academic wherewithal and fortitude is what is captured by the combination of GPA plus doing well in AP course, advanced math and science courses, or high school assessments, which together are the strongest predicators of postsecondary degree attainment.

Students who have high odds of earning a BA degree can be identified by their high school outcomes. Two-thirds of Maryland high school students from the class of 2016 who graduated with a "B" or better GPA, and had two indicators of academic skill (an AP course, Advance Math and Science Courses, scoring Advanced on either the Algebra or English high school assessment) earned a BA degree and 70% received a postsecondary award

The same does not appear to be the case for AA degrees. Contrarily, it does not appear to possible to predict which Maryland high school graduates will earn a two-year associates degree, based on the high school outcomes we examined. A key reason for this is the low overall success rate of class of 2016 high school graduates in earning AA degrees from the state's community colleges. Forty-five percent of the high school graduates from the class of 2016 enrolled in community colleges at some point within six years of 2016, but only

6% earned associates degrees. College students, who started in community colleges and transferred to four-year degree programs before earning an AA degree are counted among the students earning four-year degrees if they graduated. We also tracked the number of students earning certificates from community colleges but did not report on those outcomes because only a few percent of students earned them (data on certificate attainment can be found in the appendix). Overall, the inability to predict which high school students will earn AA degrees, suggests that the circumstances under-which Maryland high school graduates are attempting to earn AA degrees, outweigh any impact of different high school preparations or outcomes on AA degree attainment.

Obtaining high school outcomes highly aligned with postsecondary success appears to substantially reduce but not fully negate differences in postsecondary attainment rates by family income and race. Thirty percent of Maryland's high school graduates from the class of 2016, came from economically disadvantaged families. They earned postsecondary degrees at less than half the rate of high school graduates from economically advantaged families (24% to 51%). The impact of family income on college degree attainment, results in part, from the financial cost of college, which has risen considerably in the last two decades. College costs, however, does not appear to be the only factor driving differences in college attainment by family income. When high school students from low-income families have the opportunity and support needed to achieve key high school indicators of postsecondary readiness (B or better GPA, taking one or more AP course, and advanced math and science courses) their success in earning a postsecondary degree more than doubles and the gap in postsecondary degree attainment narrows. Fifty nine percent of high school graduates from economically disadvantaged families who obtain key postsecondary success indicators earn a postsecondary degree compared to 74% of high school graduates from economically advantaged families. This is still a substantial gap but not a chasm, with about six in ten well prepared but economically disadvantaged students receiving postsecondary degrees, well above the overall state average.

When higher family income is combined with receiving the support and opportunities needed for strong academic success in high school, differences in postsecondary success associated with being from a historically marginalized community appear to be greatly reduced. Black students from economically advantaged families, who graduate with an "A" average, have postsecondary success rates on par with similar white students. A greater proportion of white students, however, are afforded the double advantage of higher family income and the supports and opportunities needed to obtain an "A" average.

The opportunities and supports Maryland high school graduates receive to obtain the high school outcomes most strongly predictive of postsecondary attainment vary by school district. Where Maryland students go to school influences the likelihood that they will obtain

the high school outcomes which best prepare them for postsecondary success. When we identified the Maryland districts which had the highest and lowest percent of high school graduates earning postsecondary degrees, we also found that the districts with the greatest percent of students earning postsecondary degrees, had fewer low-income and minority students and the districts with the lowest percent of high graduates earning postsecondary degrees, had high percentages of low-income and minority students. To dig deeper into how these districts might vary on key postsecondary readiness indicators, we compared the three districts with high postsecondary outcomes, that had the fewest low income and minority students, to the three districts with lower postsecondary outcomes who had the highest percent of low income and minority students. What we found was that on the advanced course taking metrics, high school graduates from the districts with lower postsecondary outcomes generally did as well as high school graduates with higher postsecondary outcomes. This speaks favorably of Maryland districts in their efforts to spread access to advanced high school courses, as similar outcomes are not found in other states. Where major differences emerge among the lower and higher postsecondary outcome districts, is in the supports and conditions their students receive to consistently achieve good grades. Many more students in the high postsecondary outcome districts are graduating with "A" GPAs and many fewer are graduating with "C" GPAs. The most problematic difference is that twice as many high school graduates (37% vs 15%), from the districts with lower postsecondary attainment rates, graduate with a "C" GPA and one or more course failures, which our analysis identified as the strongest negative predictor of postsecondary success.

Providing students access to more advanced course requires resources but is also strongly influenced by policy and practice choices. Providing students with the supports and resources to continually do well in their courses, is considerably more challenging in districts with high percentages of students from low income to high poverty families, with significant numbers living in neighborhoods of concentrated poverty, than in districts with relatively few low-income families. In the Maryland districts who educate the highest percent of low income and minority students, students who are able to get through high school earning good grades in their classes, and avoiding course failure, are not, by and large, being held back from full postsecondary readiness due to lack of access to advanced or college level courses. The impact of which district you attend in Maryland on your odds of postsecondary success, seems to primarily be driven by likelihood, you will receive the supports and resources needed (in and out of school) to consistently get good grades and avoid course failure in your high school courses.

Some Broader Implications and Paths for Further Consideration

There is more room in the high school curriculum to enable all students to engage experiential learning, such as internships, apprenticeships, work or project-based learning, and career and technical courses than commonly assumed.

Data for the class of 2016 in Maryland, supported by analysis of three cohorts of Michigan high school graduates, as well as learnings from California, indicate that the core academic knowledge high school students need to succeed in college can be obtained through approximately 14 year-long courses, which include at least one college level course. There is room in the current high school schedule for 24 or more year-long courses. Thus, it seems possible to create more learning by doing opportunities for high school students without undermining or raising concerns about college readiness. Creating a good balance between core academic courses and experiential learning opportunities, moreover, may help increase high school student's engagement and attendance, as well as leave them better prepared for careers. High schools were traditionally designed on the premise that they could prepare a student for either college or a vocation. By showing empirically with state longitudinal data, that beyond a certain point, more academic credits do not increase the odds of college success, the door to high school redesign which enables all students to both be prepared for college success and engaged in experiential learning aligned with career readiness is opened.

Our analyses indicates that perhaps the most direct way to increase college attainment rates is to increase the number of high school students who can earn good grades in core academic and advanced classes and decrease the number of students failing them.

The number of high school graduates with good odds of earning a college degree would increase substantially if ways were found to moderately improve high school students' course outcomes. These improved outcomes need to occur in a sequence of core academic courses aligned with college readiness standards and grading rubrics, which included at least one college level course like AP/DE/IB. If more students who are now earning mostly B's and Cs in core academic and advanced courses, started earning a few more A's and a few less C's and students who are earning Cs started to earn more B's, while course failures were decreased all around, many more students would see increased odds of earning a postsecondary degree.

This suggests that one potential high value action for state school boards and education agencies is, as has been done for AP courses, and in California for core academic courses, to align course materials and assignments with preparation for college level courses and create either grading rubrics or a few common assignments or assessments to anchor course grades in some objective criteria aligned with college readiness. Once this is done, there can be a collective effort across the state to learn what types of learning opportunities and supports

students will need to achieve good grades in challenging course and how to greatly reduce course failure.

When constructing or using indicators of college readiness, for accountability and/or progress monitoring and improvement efforts it is important to include multiple metrics which collectively indicate higher and lower odds of postsecondary degree attainment.

Deep analysis of Maryland class of 2016, using state longitudinal data, which enables linking high school outcomes to postsecondary degree attainment indicates that high school graduates who have high odds of earning a BA degree leave high school with both substantial academic knowledge and skill and academic behaviors and learning skills which enable them to persistently get solid grades in their courses, across different subjects, types of instructors, while taking multiple courses at the same time. It also appears to be the case, that there are multiple ways to demonstrate the possession of substantial academic knowledge and skill. Scoring advanced (beyond proficient) on high school assessments is one way, but doing well, in college level courses like AP of high-quality dual enrollment, or advanced mathematics and science courses like calculus and physics also serve as indicators of substantial academic knowledge and skill. Academic persistence, among existing high school outcomes, is best captured by GPA. Thus, college readiness and success indicators, would be more accurate and informative if they include both multiple metrics of academic knowledge and skills (and recognize that all students do not need to meet all of the multiple metrics to have strong odds of postsecondary success) and metrics of academic persistence or the academic behaviors and learning skills to consistently get solid grades across all the courses taken during high school. Focusing on one or the other of these components of college readiness/success in isolation will lead to less effective and useful metrics. Neither high school graduates who demonstrate academic skill but not academic persistence or demonstrate academic persistence but not academic skill do nearly as well in earning college degrees, as high school graduates who demonstrate both.

It could also be worth considering, as a progress monitoring/ improvement (not accountability) metric, keeping track of high school course failures. The longitudinal data strongly indicates that even a single course failure in high school greatly reduced the odds of postsecondary success. For this to be effective it would need to be paired with grading rubrics and a course progress monitoring/early warning/student success system. The goal needs to be to provide the needed supports to students when they show the first signs of course struggle to enable them to succeed in the course. Nothing would be gained by sending a signal to just not fail students.

The notion that community colleges as currently designed are the best place for high school graduates with a "C" average needs to be rethought.

A common expression is C's get degrees. The longitudinal data for the Maryland Class of 2016 shows this is no longer the case for high school graduates earning post-secondary degrees. Forty percent of the high school graduates from the class of 2016 had a "C" average. Nearly three-fourths of these students enrolled in postsecondary institutions within seven years of high school graduation. Seven years after high school graduation, only 29% of the "C" average high school graduates had earned a postsecondary degree. The largest drop off between enrollment and degree attainment occurred at the community college level. Forty two percent of the "C" average high school graduates enrolled in community colleges but only 5% earned associate degrees. This suggests that a common viewpoint which sees community college, with its open and more rolling admissions, shorter time span, often lower costs, and fields of study more closely aligned with local employment opportunities as a better post-secondary option for high school graduates with a "C" average, is not supported by the longitudinal postsecondary success data for the class of 2016. "C" average high school graduates who enrolled in four-year institutions had greater odds of success, 31% enrolled and 23% earned BA degrees. Part of the difference may well be explained by the fact, that not all "C" average high school graduates are the same. Those, who also scored advanced on their high school assessments, took an AP or advanced math and science courses, and did not fail any classes, have substantially better postsecondary outcomes than those who scored proficient but not advanced on their assessments, did not take advanced or college level courses, and failed one or more of their courses. What is clear, is that the "C" average high school graduates, who enrolled in community colleges rarely succeeded in earning an AA degree. Nor did they transfer to four-year colleges and earn Bachelor's degrees or obtain certificates from community colleges in large numbers. Data from a similar longitudinal study for Michigan (Balfanz & Byrnes 2025) showed that high school graduates with a C average attending community colleges, constituted the overwhelming majority of college students taking remedial (typically) non-credit courses. This suggests that the default assumption of community colleges, as currently designed, being seen as the best post-secondary destination for high school graduates with a "C" average needs to be re-thought. Three options need to be explored. Developing more effective postsecondary pathways for high school graduate who do just enough to pass in high school, fail a course or more along the way, and do not enroll in advanced courses. Providing community colleges with additional resources to more robustly support high school graduates with a "C" average and a history of course failures, from the first day of college forward. Redesigning high schools to enable all students to do more than just pass. The MLDS Centre data shows a not insubstantial number of "C" students took and

succeeded in college level course (and subsequently earned college degrees), and Maryland more broadly has shown that a far greater range of students, than has commonly been thought, can take and succeed in AP courses. This suggests with appropriate and sufficient supports, there does not have to be trade off, between more challenging course and course failure rates.

Addressing the finding that "C"' averages in high school, by and large do not get college degrees, should be aided by even more intensive use of the state longitudinal data systems. There are important variations that can only be well understood with longitudinal data. The current analysis shows it would be a mistake to simply move from "C"'s get degrees, to "C"'s do not get degrees, and start counseling or messaging to all "C" students that they should not apply to two- or four-year colleges. The longitudinal data for the Class of 2016, clearly shows that not all "C" students are the same, and that some of them clearly can and do earn college degrees. Those that do typically, have indicators beyond their C average which are aligned with greater odds of postsecondary success. They have an advanced score on a high school assessment or have taken and done well in an AP or advanced science or math course, and they have not failed any courses. Research done in Rhode Island points to a further complexity in understanding the odds of postsecondary success for "C" students. It has shown that significant numbers of high school students, have substantial family care responsibilities, for siblings, grandparents living in their home, and parents with medical conditions or a family support role by earning income (Armstrong-Carter, et al. (2024). Students who just pass courses in high school because of large out of school responsibilities may have very different college outcomes, especially if they had a solid baseline of academic skills and knowledge prior to their increased family responsibility, if some of these responsibilities are reduced when they attend college.

▸▸▸ Conclusion

The Power of State Longitudinal Data Systems in Establishing How High School Experience Shape Students Odds of Earning College Degrees

This study and its companion done with data from the Michigan State Longitudinal Data System shows that state longitudinal data systems have the potential to bring much needed clarity to what about student's high school experiences prepares them for college success. Long held assumptions the more academic credits are better, and that a combination of earning required credits and meeting assessment criteria, signals college readiness do not hold up when a cohort of students is followed through high school and into and through college. Instead, a more complex picture emerges with experiences that propel high school students toward college success and others which push it away. Taking a core set of academic courses

and doing well in them matters. As does taking at least one college level course. But beyond this which can be completed in about 3/4th of four years of high school, there is more room for exploration, choice, and experiential learning opportunities without sacrificing college readiness then sometimes thought. Taking challenging course, AP, Dual enrollment, other college in high school options, as well as advanced science and mathematics courses, helps prepare, A, B and C students for college success. The data is clear, these courses should not be reserved for only A students. On the negative side of the ledger, failing courses in high school appears to have a particularly strong effect on lowering the odds of college success. The longitudinal data from Maryland and Michigan for students who graduate high school in the 2010's, indicates that far too many of them graduated having experienced course failure and with a C average. Most enrolled in college and few succeeded. This is a group of students we need to urgently understand better and create stronger supports and pathways to adult success than currently exist. These are insight, state and district school leaders may find on their own, but using state longitudinal data systems, gives us confidence that we can build the next generation of high school graduation and college readiness requirements around the lived experiences of all of a state's recent high school graduates. This allows for important state variation and also collectively will enable us to learn more broadly what really matters about high school for post-secondary success.

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