Maryland College and Career Readiness Empirical Study

Interim Report on the Predictive Validity Analysis

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Executive Summary

The *Blueprint for Maryland's Future*, passed by the 2021 Maryland General Assembly, requires that a college and career readiness (CCR) standard be set for Maryland public school students that "certifies that by the end of 10th grade, and not later than the end of 12th grade, a student has the requisite literacy in English and math to be successful in first-year, credit-bearing coursework at a Maryland community college or open enrollment postsecondary institution" (Blueprint for Maryland's Future Act, 2021, p. 9). The Maryland State Department of Education (MSDE) contracted with the American Institutes for Research® (AIR®) to conduct a study of the interim CCR standard and to explore additional potential measures of student readiness for college and career success. The study includes two components: (1) a predictive validity analysis and (2) a content and alignment analysis.

This report presents preliminary findings from one component of the empirical study: a predictive validity analysis to inform continued development of the state's CCR standard. An interim report with preliminary findings from the content and alignment analysis will be completed in June 2023 and a final report that includes findings from both components of the study will be completed by September 2023.

Preliminary Takeaways

In this interim report, we examined how well high school measures of CCR at the end of a student's second year of high school (10th grade) predict postsecondary progress. The analysis focused on students in Maryland public high schools who enrolled in a Maryland college the fall after their expected high school graduation. The preliminary findings support the following key takeaways:

- **The interim CCR standard, utilizing state assessments, correctly classified 56%–70% of students as college ready or not college ready at the end of 10th grade.** Overall, 40% of students who enrolled in a Maryland college the fall after their fourth year of high school met the interim CCR standard by the end of their 10th grade

Approach to the Predictive Validity Analysis

For the interim report, the analysis was based on Maryland public high school students who were in the expected high school graduation classes of 2017–2021 and focused on students who enrolled in a Maryland college the fall after their fourth year of high school.

The interim analysis focused on four high school measures of CCR at the end of a student's second year of high school:

- English 10 state assessment
- Algebra 1 state assessment
- PSAT composite scores
- Overall HSGPA

To assess the quality of different high school measures of CCR, we examined how well the high school measures of CCR predicted progress toward postsecondary success. The interim analysis focused on two measures of postsecondary progress in a student's first semester in college:

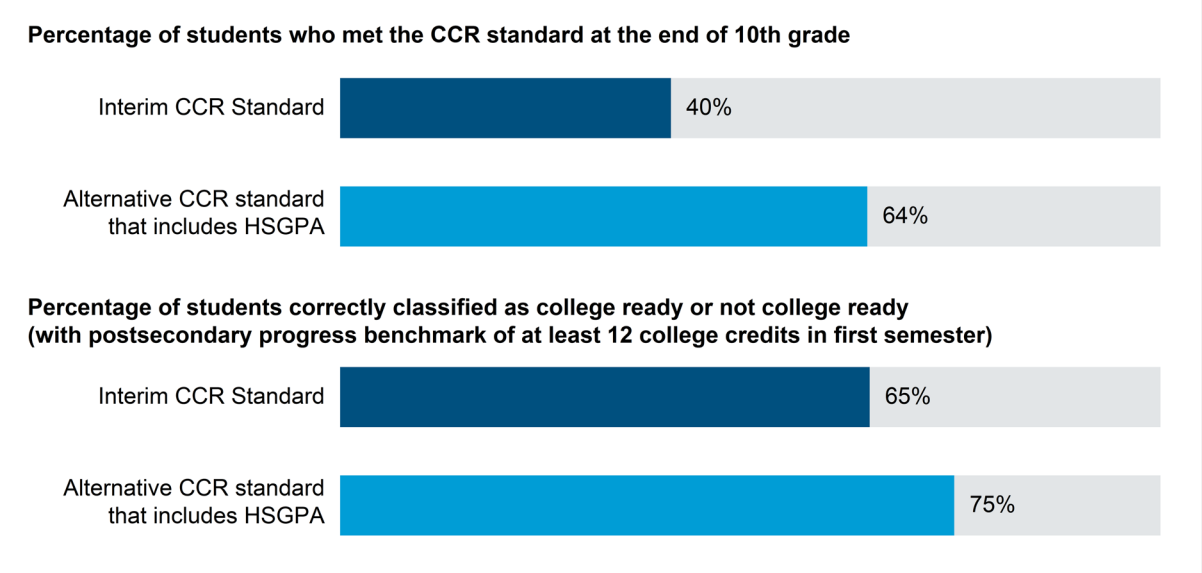
- Number of college course credits accumulated
- Overall college GPA

year. The interim CCR standard correctly classified 56%–70% of students as college ready or not college ready, depending on the postsecondary progress benchmark used to validate readiness. This means that the interim CCR standard could misclassify 30%–44% of students at the end of their second year of high school.

- **Adding an alternative way to meet the CCR standard with HSGPA increased the percentage of students who meet the CCR standard and improved accuracy rates.** Including a way to meet the standard with the interim CCR standard criteria or a high school grade point average (HSGPA) of at least 3.0 at the end of 10th grade increased the percentage of students who met the CCR standard from 40% to 64%. In addition, an alternative CCR standard with HSGPA correctly classified 67%–75% of students as college ready or not college ready, depending on the postsecondary progress benchmark used to validate readiness. This means fewer students will be misclassified at the end of their second year of high school if CCR determination is based on student performance on state assessments or a student's HSGPA, rather than state assessments only.

Comparison of the Interim CCR Standard to An Alternative CCR Standard With HSGPA

Among students who enrolled in a Maryland college the fall after their fourth year of high school



Note. A student can meet the interim CCR standard by meeting or exceeding performance expectations on the English 10 state assessment and a high school math assessment (Algebra 1, Algebra 2, Geometry, or the SAT math test). A student can meet the alternative CCR standard by meeting the interim CCR standard requirements or having an overall HSGPA ≥ 3.0. *N* = 121,002 for the percentage of students who met the CCR standard at the end of 10th grade. *N* = 117,819 for the percentage of students correctly classified as college ready or not college ready based on a postsecondary progress benchmark in the first fall semester after a student's fourth year of high school. CCR = college and career ready; HSGPA = high school grade point average.

- Adding HSGPA into the CCR standard improved accuracy rates more for students who attended a Maryland public 4-year college (69%–81% with HSGPA compared to 62%–68% without HSGPA) than for students who attended a Maryland public 2-year college (64%–69% compared to 51%–72%).
- Adding HSGPA into the CCR standard improved the accuracy rate for many student groups. For example, with a postsecondary progress benchmark of at least 12 college credits in the first semester, the accuracy rate for only two of the 10 student groups examined was at least 70% with the interim CCR standard. The accuracy rate for nine of the 10 student groups was at least 70% with HSGPA added to the CCR standard.

Limitations to the Preliminary Analysis

When interpreting the findings and takeaways presented in this report, one should consider the potential limitations and interim nature of the data and analysis. The analysis was restricted to students who attended a Maryland college the fall after their fourth year of high school, which means that the results pertain to the subset of students who are college bound immediately after high school. In addition, the interim results reflect averages for Maryland college-going students and may not properly reflect the readiness of specific students or postsecondary aspirations.

Next Steps

For the final report (due in September 2023), we will expand on the preliminary analysis to provide a more comprehensive picture of what a CCR standard might mean for Maryland's students. In particular, we plan to examine additional high school measures of CCR (e.g., success in advanced high school courses and career and technical education courses) and additional postsecondary pathways (e.g., students who attended a non-Maryland college, students with delayed college enrollment, students who went into the workforce). In addition, we will continue to revise our approach to the predictive validity analysis for the final report based on what we learn from this study's standards and content alignment analysis as well as ongoing discussions with MSDE and other key stakeholder groups.

A. Introduction

A central goal of the *Blueprint for Maryland's Future*, passed by the 2021 Maryland General Assembly, is to ensure that all Maryland public school students are college and career ready before graduating from high school, signifying an ability to transition successfully to postsecondary coursework at a 2- or 4-year postsecondary institution or to the workforce. To reach this goal, the *Blueprint* requires that a college and career readiness (CCR) standard be set for Maryland public school students that "certifies that by the end of 10th grade, and not later than the end of 12th grade, a student has the requisite literacy in English and math to be successful in first-year, credit-bearing coursework at a Maryland community college or open enrollment postsecondary institution" (Blueprint for Maryland's Future Act, 2021, p. 9). Further, the *Blueprint* requires that the Maryland State Department of Education (MSDE) contract with a public or private entity to conduct an empirical study of the interim CCR standard set by the Maryland State Board of Education to determine whether that standard reflects and/or predicts whether a student will be successful in entry-level credit-bearing courses or postsecondary education at a state community college.

Maryland's Interim CCR Standard

In February 2022, the Maryland State Board of Education set an interim CCR standard. The standard states that students are considered college and career ready when they meet or exceed a metric in both English and math, as defined by the following criteria:

- **English**: Score at or above the proficient (or met expectations) performance level on the English 10 state assessment
- **Math**: Score at or above the proficient (or met expectations) performance level on the Algebra 1, Algebra 2, or Geometry state assessment or score at least 520 on the SAT math test

In August 2022, MSDE released an implementation roadmap for the CCR policy established in the *Blueprint* (MSDE, 2022). In the roadmap, MSDE highlighted the importance of establishing a CCR standard that reflects the skills and knowledge necessary to succeed in the first year at a community college, as well as what it means to be equipped to thrive in any postsecondary or career environment. The roadmap also outlined the call for an empirical study that (a) not only meets the requirements of the *Blueprint* but also examines alternative indicators of readiness, (b) further studies the alignment between the Maryland interim CCR standard and current content standards required by postsecondary institutions and industry, and (c) considers potential sources of bias in any proposed CCR standard. In its conclusion, the roadmap stipulated that the empirical study should inform adoption of a CCR standard that best predicts whether a student is ready for college and career, without a disproportionate impact on any student group.

MSDE contracted with the American Institutes for Research (AIR) to conduct the empirical study required by the *Blueprint* and to explore additional possible measures of student readiness for college and career success. The empirical study includes two components:

- A **predictive validity analysis** to determine whether the interim CCR standard predicts whether a student is ready to progress toward postsecondary success
- A **content and standards alignment analysis** to determine the levels and types of literacy in English language arts and math needed for postsecondary success (see sidebar).

This report presents preliminary findings from the predictive validity analysis. We start with a summary of prior research related to measuring CCR. Next, we provide an overview of our approach to the predictive validity analysis and then present the preliminary results from that analysis. We conclude the report with a summary of our preliminary takeaways, a discussion of the limitations to the analysis, and an overview of next steps.

For the final report (due in September 2023), we will expand on and continue to revise our approach to the predictive validity analysis based on what we are learning from this study's standards and the content alignment analysis, as well as ongoing discussions with MSDE and other key stakeholder groups.

Content and Standards Alignment Analysis

In addition to the predictive validity analysis, the Maryland CCR Empirical Study includes a content and standards alignment analysis with three key research activities.

- **Inventory course requirements** to identify requirements for first-year credit-bearing English, math, and science courses and remedial courses at each Maryland community college.
- **Collect stakeholder engagement via focus groups** with Maryland postsecondary faculty, workforce representatives, and K–12 leaders to provide important context to the information collected through the programmatic survey and collect information on potential sources of bias in assessments.
- **Develop Maryland postsecondary CCR conceptual frameworks** to articulate postsecondary readiness expectations across Maryland's postsecondary institutions and employers.

The study's final report will include results from the predictive validity analysis and the content and standards alignment analysis.

B. Summary of Existing Practices and Prior Research

To inform our approach to the predictive validity analysis and help situate the analysis within a larger CCR knowledge base, this section summarizes prior research on frameworks for CCR and its relationship to postsecondary progress.

B.1. A Framework for College and Career Readiness

Although this study focuses on identifying and assessing high school indicators for CCR, it is important to situate the work within a broader framework for preparing students to succeed in the postsecondary pathway(s) of their choice. A commonly cited definition of college readiness offered by Conley (2010) describes college readiness as "the level of participation a student needs in order to enroll and succeed—without remediation—in a credit-bearing course at a postsecondary institution" (p. 21). Conley (2012) furthered his definition of college readiness by establishing a four-dimension framework for readiness that includes career-ready skills needed for students to be prepared for both higher education and the workforce:

- **Content knowledge** demonstrated through understandings of the key ideas, concepts, and vocabulary in core academic subjects such as English, math, science, and the social studies (e.g., performance on state content assessments)
- **Cognitive strategies** such as problem solving, reasoning, analysis, and interpretation skills necessary for success on the job and in college-level coursework
- **Academic behaviors** that promote student ownership of learning (e.g., self-awareness, self-monitoring, study skills) and transcend content-area knowledge
- **Contextual skills and awareness** about the informal and formal systems and culture of the institution that enable the transition to life beyond high school (e.g., knowledge of postsecondary admissions requirements, understanding workforce norms).

A framework developed by the College and Career Readiness and Success Center at AIR (Balestreri et al., 2019) advances Conley's framework for readiness by situating CCR within a comprehensive system for success that organizes CCR components into four strands:

1. Learners have clear **goals and expectations** about what they should know and be able to do to achieve CCR.
2. Learners know the **outcomes and measures** used to identify whether they are meeting expectations for CCR and success.
3. Institutions provide **pathways and supports** that enable learners to achieve college and career success.

4. Institutions have the robust **resources and structures** needed to enable learner readiness for college and careers**.**

An important feature of the framework offered by Balestreri et al. (2019) is that defining and measuring a CCR standard happens within the context of institutional supports, resources, and structures. A CCR standard can set clear goals and expectations (Strand 1) and establish CCR outcomes and measures (Strand 2), but the quality of the standard may depend on how well existing institutional systems develop CCR (Strands 3 and 4). Thus, a CCR standard should be seen as not only a tool to gauge individual student readiness but also a way to inform institutional and system-level change.

Much of the literature focuses on the role of content knowledge for CCR. Relatively little research examines statewide policies on the development, implementation, and effects of cognitive strategies, academic behaviors, and contextual skills and awareness on college and career success. Even with widespread agreement about the importance of CCR, it is difficult to develop a universal measure of readiness because there is less consensus about what constitutes readiness and how to measure it (Klasik & Strayhorn, 2018; Maruyama, 2012).

Most of the knowledge and skills captured in Conley's four dimensions are not commonly captured by state assessment and data systems, highlighting the fact that efforts to measure CCR based on existing academic content measures are inherently limited. Furthermore, as Conley (2012) noted, the "precise knowledge and skills profiles necessary to be ready for postsecondary studies" (p. 1) can differ across students, based on their interests and postsecondary aspirations, and the definition of success should be tailored to a student's chosen field of postsecondary education or training. This individualized orientation to postsecondary success means that efforts to assess the quality of a CCR measure or standard will be limited to the students studied and the definition(s) of postsecondary success examined.

B.2. Existing Practice

Since the enactment of the Every Student Succeeds Act of 2015 and its policy mandate for states to establish more explicit CCR requirements in their K–12 academic standards, states have responded with varied approaches to measure, monitor, and report on their students' CCR. In most cases, states use standardized tests, such as their own state assessments, the SAT, or the ACT, to measure readiness among high school students. Many states also use high school coursework and grades to determine readiness.

Although some states determine their students' college readiness based a single standardized test (e.g., ACT, SAT/PSAT), others use multiple measures to determine readiness. California, for example, established criteria to determine whether a high school graduate is "prepared" or "approaching prepared" for college based on whether a student meets at least one of the

criteria based on state assessment scores, scores on Advanced Placement (AP) or International Baccalaureate (IB) examinations, passing college-level courses, or completing certain course requirements with a grade of C or better.

In parallel to changes among K–12 education systems, there has been a growing movement in the past decade for broad and open access postsecondary institutions (e.g., community colleges, 4-year colleges with high acceptance rates) to adopt a "multiple measures assessment" approach when determining incoming students' appropriate placement in either developmental education or credit-bearing college-level courses. Under this approach, institutions do not rely on only one traditional placement examination (e.g., ACCUPLACER) to determine placement but rather consider a range of academic measures that allow students greater opportunity to demonstrate their readiness for college-level coursework. For example, in Maryland, all community colleges and a majority of the public 4-year and independent colleges use more than one assessment tool to determine students' course placement (Maryland Higher Education Commission, 2021). The most common academic measures include SAT/ACT, AP, and high school grade point average (HSGPA), among others.

Although theoretically distinct from college readiness, career readiness often is defined by the same metrics as college readiness. The number of states with career-focused measures in their CCR indicators has more than doubled since 2014 (Advance CTE, 2019), but these indicators often do not isolate career readiness as a separate metric with its own distinct requirements. A potential career readiness metric often included in measures of CCR is participation in career and technical education (CTE) programs designed to prepare students with technical skills and knowledge for specific occupations (Hirschy et al., 2011). As of 2019, 23 states included participation or completion in a CTE pathway or course as a component of CCR (Advance CTE, 2019). Moreover, 10 states incorporated experiential, work-based learning into a measure of career readiness, yet challenges exist in how to measure and standardize what counts as acceptable work-based learning (Advance CTE, 2019).

B.3. Measures of College and Career Readiness

Although a case could be made for several measures of CCR, most attention has focused on measures that are readily available in K–12 education data systems (e.g., state-specific standardized assessment scores, SAT/ACT scores, HSGPA) or used for college placement or college coursework decisions. These measures often are defined by threshold scores or benchmarks intended to signal readiness. In this section, we briefly highlight findings from recent research on various CCR measures and their associations with subsequent postsecondary outcomes. (For a fuller discussion of the relevant literature, see the Technical Appendix.)

College Readiness

College Admissions and Placement Test Scores. Norm-referenced standardized tests used for college admissions decisions (e.g., SAT, ACT) and college-level course placement decisions (e.g., COMPASS, ACCUPLACER) often are the focus of research on CCR measures as predictors of postsecondary student success. For example, studies found positive associations between students' SAT scores (e.g., Marini et al. 2019) and ACT scores (e.g., Westrick et al., 2015) and their first-year college GPA (FYGPA). Other studies, however, found that relative to other potential CCR measures, particularly HSGPA, the predictive validity of SAT and ACT test scores alone may be limited in predicting college outcomes such as FYGPA (Rothstein, 2004) and college completion (Allensworth & Clark, 2020).

Similarly, studies on the predictive validity of college-level course placement tests such as COMPASS and ACCUPLACER find positive but weak associations between test scores and college outcomes such as course grades, college GPA, and college credits earned (Bahr, 2016; Belfield & Crosta, 2012; Scott-Clayton, 2012).

State-Specific Standardized Assessment Scores. Studies within different states found positive associations between content-aligned assessments administered to high school students and college GPA (Cimetta et al. 2010; Coelen & Berger; 2006; McGhee, 2003). Additional research found that scores on state content assessments were comparable to other CCR measures, particularly ACT/SAT test scores, in terms of their ability to predict college outcomes such as FYGPA (Fina et al., 2018; Koretz et al., 2016; Nichols-Barrer et al., 2015).

HSGPA. Several studies on college readiness examined how well HSGPA predicts college outcomes, even as researchers acknowledge potential limitations of HSGPA because of the subjective nature of grading (Brackett et al., 2013; Kunnath, 2017; Lipnevich et al., 2020) and evidence of grade inflation (Camara et al., 2004; Sanchez & Moore, 2022). Despite these concerns, several studies indicated that HSGPA is a strong and reliable predictor of various college outcomes, including initial college enrollment and sustained enrollment for more than one term (Hester et al., 2021), overall college GPA and college credits earned (Belfield & Crosta, 2012), and college completion (Allensworth & Clark, 2020). Compared with other test-based measures, studies found that HSGPA was a stronger predictor of college completion than SAT/ACT scores (Allensworth & Clark, 2020; Galla et al., 2019; Koretz et al., 2016).

A recent study conducted by the Maryland Assessment Research Center (MARC, 2023) compared how well HSGPA predicted FYGPA compared with college admissions tests (SAT and ACT) and state assessment scores for Maryland public high school graduates who attended a Maryland public college. The study found that the relationships between the different high school measures and college FYGPA were stronger among 4-year college attendees

(correlations between 0.42 and 0.44) than 2-year college attendees (correlations between 0.25 and 0.36). However, at both 4-year and 2-year colleges, HSGPA was a better predictor of which students earned a FYGPA of at least 3.0 than the Partnership for Assessment of Readiness for College and Career (PARCC), SAT, or ACT.

High School Course-Taking. High school course-taking is another potential measure of CCR commonly examined by researchers. Though defined differently across studies, measures of "curricular intensity" (e.g., highest math course completed) had strong positive associations with postsecondary persistence and bachelor's degree completion (Adelman, 1999, 2006; Austin, 2020). Similarly, Hester et al. (2021) found that among Arkansas high school students, taking at least one advanced course—defined as AP, IB, or advanced career education—was the strongest predictor of college enrollment and persistence among the CCR measures examined.

Multiple Measures for College Readiness. Although much of the research on college readiness focuses on specific measures, studies highlighted the strengths of using multiple measures to predict college readiness, including the combination of ninth-grade GPA, completion of advanced coursework (i.e., AP, IB, dual enrollment), and participation in CTE coursework (e.g., Education Strategy Group, 2020). Similarly, research on college course placement decisions points to the benefits of using multiple measures. Several recently published studies consistently found that using multiple measures for placement in community college developmental courses resulted in better student outcomes (e.g., college credits earned) than using a single measure such as a placement test score (Bergman et al., 2023; Cullinan & Biedzio, 2021; Cullinan & Kopko, 2022).

Career Readiness

Measures of career readiness are less standardized and less often viewed as separate from measures of college readiness. Despite this lack of a clear distinction between CCR measures in the research literature, one relatively common measure associated with career readiness is student participation in CTE. Growing evidence shows that increased exposure to CTE, by attending a dedicated CTE high school or being a CTE "concentrator" in high school, is positively associated with increased employment and higher earnings (Ecton & Dougherty, 2023; Lindsay et al., 2021).

C. Approach to the Predictive Validity Analysis

We designed the predictive validity analysis with two objectives in mind:

- Our primary objective is to address the requirements stipulated in the *Blueprint* to examine whether Maryland's interim CCR standard predicts student success in entry-level credit-bearing courses or postsecondary education training at a state community college. To meet this objective, our analysis focuses on (a) the high school measures of CCR included in the interim CCR standard and (b) Maryland public high school students who attended a Maryland community college.
- Our secondary objective is to inform continued development of the state's CCR standard by examining how the interim CCR standard and alternative specifications of the standard predict postsecondary progress across a range of common postsecondary pathways taken by Maryland public high school students. To meet this objective, our analysis looks at additional high school measures that could be used in a CCR standard for a broader set of Maryland public high school students.

Across both objectives, we examined the extent to which the high school measures of CCR, or a particular CCR standard, operate equitably across different student groups.

For this interim report, we focused on a subset of the readiness measures and postsecondary pathways that will be included in the final report. In addition, we will continue to revise our approach to the predictive validity analysis for the final report based on what we are learning from this study's standards and content alignment analysis as well as ongoing discussions with MSDE and other key stakeholder groups.

In the remainder of this section, we describe our current approach to the predictive validity analysis, including the guiding research questions, how we defined the student sample, how we defined the measures of readiness and postsecondary progress included in the analysis, and the statistical methods used to conduct the analysis. Additional details about our approach are in the Technical Appendix.

DEFINITION OF KEY TERMS

Throughout this report, we use the following operational definitions for key terms:

- **Postsecondary pathways** refer to different sequences of college enrollment and/or workforce participation a person makes after exiting from formal K–12 schooling.
- **Initial postsecondary pathway** refers to the postsecondary pathway a person starts in the fall after their fourth year of high school, regardless of whether they graduate from high school on time.
- **High school measures of CCR** (i.e., readiness measures) refers to measures of a student's performance or achievement during their K–12 academic career that could be an indicator of readiness to successfully progress through a postsecondary pathway.
- **CCR standard** refers to a set of conditions or decision rules to determine whether a student (or high school graduate) meets the minimum expectations for CCR, based on benchmarks for one or more high school measures of CCR.
- **Measures of postsecondary progress** refer to post-high school measures of positive progress toward college and/or career success.
- **Benchmarks of postsecondary progress** refer to a minimum threshold on a measure of postsecondary progress that signals that a person is making adequate progress toward college and/or career success.

C.1. Guiding Research Questions

The following research questions guided our approach to the predictive validity analysis:

1. How should high school measures of CCR be operationalized to best predict whether students will be successful in entry-level credit-bearing coursework?[1]
2. How well does Maryland's interim CCR standard predict student success in entry-level credit-bearing coursework?
3. How well do alternative CCR standards predict student success in entry-level credit-bearing coursework?
4. How well do potential CCR standards and the high school measures of CCR predict postsecondary progress along different types of postsecondary pathways?
5. To what extent do the potential CCR standards and high school measures of CCR perform equitably across student groups?

[1] For the broader study, the research questions pertain to success in entry-level credit-bearing coursework or postsecondary education training. For the interim report, we do not address success in education training programs because the available data are not sufficient to determine who enrolls in and completes an education training program.

C.2. Students Included in the Analysis

The analysis is based on Maryland public high school students who were in one of five cohorts. The student cohorts were defined based on a student's expected on-time high school graduation year from the time they were a first-time ninth grader.[2] Because the analysis requires data from a student's time in high school and, minimally, the first year after high school, we included students who were in the expected high school graduation classes of 2017–2021 (see Exhibit C.1). Throughout this report, we refer to years relative to when a student entered ninth grade, such that the first year is High School Year (HSY) 1 and the fourth year is HSY4. After the expected on-time high school graduation year, we refer to years relative to the expected postsecondary year (i.e., Postsecondary Year [PSY] 1 for the first year after expected high school graduation). Students in the class of 2017, for example, started ninth grade in the 2013–14 school year (HSY1), were expected to graduate high school in the 2016–17 school year (HSY4), and would then enter an initial postsecondary pathway in the 2017–18 school year (PSY1).

Three of the student cohorts (the classes of 2019, 2020, and 2021) had their high school and/or initial postsecondary experiences disrupted by the COVID-19 pandemic. To examine whether the results from the analysis are distorted by pandemic-related anomalies, we looked at the extent to which key indicators of high school and postsecondary progress differed across student cohorts.

Data Source

We used data from the Maryland Longitudinal Data System (MLDS) Center to conduct the predictive validity analysis. The MLDS connects student data from across Maryland's education and workforce agencies, including the Maryland State Department of Education, the Maryland Higher Education Commission, and the Maryland Department of Labor. These data support the examination of student preparation, progress, and outcomes across time, K–12 public schools, postsecondary education and training, and the workforce.

We accessed MLDS data from as far back as the 2011–12 school year and as recently as the 2021–22 school year (the most recent year of data available at the time we started the analysis). The K–12 data cover only those students who attended a Maryland public school, and the postsecondary data on course credits and GPA are available for only those students who attended a Maryland college or university affiliated with the Maryland Higher Education Commission.

[2] We determined a student's first-time ninth-grade year based on the end-of-year grade level for each student. A student could be assigned to a particular cohort in one of three ways: (a) the student was in Grade 9 in HSY1 and Grade 8 the previous year; (b) the student was in Grade 9 in HSY1 and not in a Maryland public school the previous year; or (c) the student was in Grade 10 in HSY2 and not in a Maryland public school in HSY1.

Exhibit C.1. Student Cohorts and Timing of High School and Postsecondary Progress

School year	Expected on time high school graduation class year				
	2017	2018	2019	2020	2021
2013–14	HSY1				
2014–15	**HSY2**	HSY1			
2015–16	HSY3	**HSY2**	HSY1		
2016–17	**HSY4**	HSY3	**HSY2**	HSY1	
2017–18	PSY1	**HSY4**	HSY3	**HSY2**	HSY1
2018–19	PSY2	PSY1	**HSY4**	HSY3	**HSY2**
2019–20	PSY3	PSY2	PSY1	**HSY4**	HSY3
2020–21	PSY4	PSY3	PSY2	PSY1	**HSY4**
2021–22		PSY4	PSY3	PSY2	PSY1

Note. HSY# = high school year; PSY# = postsecondary year (number of years a student has been in a postsecondary pathway if they graduated on time from high school). The years in bold underline indicate the years the student samples and high school measures of CCR were defined.

Student Samples

Because the *Blueprint* calls for the assessment of student readiness "by the end of 10th grade, and not later than the end of 12th grade," our primary student sample was restricted to students enrolled in a Maryland public high school at the end of their second year of high school (HSY2), when most students should be in 10th grade. We also examined a secondary sample that was further restricted to students who graduated from a Maryland public high school within 4 years of entering ninth grade (i.e., by the end of HSY4).[3] Exhibit C.2 presents, by cohort, the total number of students included in the primary sample and the percentage who fall into the secondary sample. Overall, the primary sample includes 318,967 students, and about 85% of them were on-time high school graduates. The graduation rates are consistent across cohorts, providing evidence that any COVID-19 pandemic disruptions did not significantly alter high school graduation rates for the classes of 2020 and 2021. Student characteristics for the primary and secondary student samples are in Exhibit C.3.

[3] High school graduation is defined as having earned a high school diploma, earned a certificate of completion, or attained early college admission within 4 years of entering ninth grade.

Exhibit C.2. Percentage of Students in the HSY2 Sample With On-Time High School Graduation, by Cohort

Student cohort	Number of students in HSY2 sample	Percentage with on-time high school graduation
Total student sample	318,967	85%
Class of 2017	61,514	86%
Class of 2018	63,775	85%
Class of 2019	63,020	85%
Class of 2020	65,853	85%
Class of 2021	64,805	86%

Note. HSY = high school year.

Exhibit C.3. Student Characteristics for the Grade 10 Sample and the High School Graduate Sample

Student characteristic	HSY2 sample	High school graduate sample
Total number of students	318,967	272,012
Sex/gender (%)		
Female	49%	51%
Male	51%	49%
Race/ethnicity (%)[a]		
Asian	7%	7%
Black/African American	34%	33%
Hispanic/Latinx	16%	14%
White	40%	42%
Multiracial	4%	4%
Percentage English learners (ELs), current[b]	6%	4%
Percentage ELs, recent exit[b]	4%	5%
Percentage students with disabilities	10%	8%
Percentage FARMS eligible	38%	34%

Note. Student characteristics were defined based on a student's status as of the end of their HSY2. FARMS = free and reduced-price meals services; HSY = high school year.

[a] Less than 1% of students were classified as American Indian, Alaska Native, Native Hawaiian, or Pacific Islander.

[b] For the purposes of our analysis, students were considered a current EL if they were classified as an EL at the end of their HSY2. ELs were considered a recent exit if they were reclassified within 2 years prior to the end of their HSY2.

Initial Postsecondary Pathways

What constitutes "readiness" and what measures of postsecondary progress are available may depend on the postsecondary pathway a student takes after high school. As a result, we disaggregated the student samples based on a student's initial postsecondary pathway. Initial postsecondary pathways were defined based on enrollment in a postsecondary institution in the fall term immediately following expected on-time high school graduation (e.g., spring 2017 high school graduates enrolling in postsecondary institutions in fall 2017). We categorized students into the following postsecondary pathways:

- Maryland public 2-year postsecondary institutions (i.e., community colleges)
- Maryland public 4-year postsecondary institutions (e.g., University System of Maryland institutions)
- Maryland private 4-year postsecondary institutions
- Non-Maryland 4-year institutions[4]
- Non-Maryland 2-year institutions[5]
- No college enrollment (i.e., students who have no college enrollment record in the fall term after expected on-time high school graduation)

This interim report focuses on the initial postsecondary pathways for students who enrolled in a Maryland college. A list of the colleges and universities included in each Maryland postsecondary pathway is in the Technical Appendix (Exhibit T.1). For the final report, we will conduct an additional analysis that examines initial postsecondary pathways for students who enrolled in a non-Maryland 4-year institution or had "no college enrollment," including students who went directly into the workforce or a training program or who delayed college enrollment for a year or two. We do not report on the non-Maryland 2-year institution pathway because less than 1% of students in our sample had this initial postsecondary pathway.

Across the five student cohorts examined, about half of the students (54%) attended a college in the fall immediately after their HSY4. About 28% of the students attended a Maryland college. In the Technical Appendix, we provide breakdowns of the percentage of the HSY2 student sample in each initial postsecondary pathway (i.e., the pathway in the fall of PSY1) by cohort (Exhibit T.2a), student group (Exhibit T.2b), and local educational agency (LEA; Exhibit T.2c). The cohort-specific college-going rates hint at a possible effect of the COVID-19 pandemic, with a slight uptick in the percentage of students not attending college for the 2020

[4] We included the U.S. Naval Academy in the out-of-state pathway because it is a federally operated institution. Approximately 50 students in our sample enrolled at the U.S. Naval Academy for their initial postsecondary pathway.
[5] Includes one student enrolled at an out-of-state less-than-2-year institution.

and 2021 cohorts. The breakdown by student group highlights the fact that some student groups are underrepresented in college. In particular, Black students, Hispanic students, students experiencing poverty (as proxied by free and reduced-price meals services [FARMS] eligibility), English learners (ELs), and students with disabilities were less likely to have a college-going initial postsecondary pathway compared with their peers. Because our analysis of CCR in the interim report focuses on students who enrolled in a Maryland college, the systematic underrepresentation could limit how well the results apply to all student populations.

C.3. High School Measures of College and Career Readiness

Our analysis of potential high school measures of CCR was limited to measures available in the MLDS data for the years students in our study sample were in high school. The interim CCR standard, for example, is based on the state assessment for English 10, Algebra 1, Algebra 2, and Geometry, as well as the SAT math test. During the time period in which the student sample was in high school (2013–14 to 2020–21), the Maryland state assessment changed from the Maryland High School Assessment (HSA) to the PARCC in 2016 and then to the Maryland Comprehensive Assessment Program (MCAP) in 2021.[6] The HSA included a reading and math assessment that is analogous to the English 10 and Algebra 1 requirements in the interim CCR standard but did not include tests of Algebra 2 or Geometry. Both the PARCC and MCAP have tests for English 10, Algebra 1, Algebra 2, and Geometry. At the time of this study, MCAP scores were not available in the MLDS, although almost all the students in our study sample should have taken at least English 10 and Algebra 1 prior to the state's transition to the MCAP.

In addition to the tests included in the interim CCR standard, we sought to examine other test-based measures and non-test-based measures available in the MLDS that might be used to determine CCR. The additional test-based measures we considered include the PSAT (composite, reading, and math), SAT (composite, reading, and math), and ACT (composite, reading, and math). For the non-test-based measures, we considered HSGPA and advanced course success.

We defined each potential measure at two different time points: (a) by the end of a student's HSY2 and (b) by the end of a student's HSY4. In the Technical Appendix (Exhibit T.3), we define each measure considered for the analysis.[7]

[6] The MCAP officially started in 2019, but the 2019 administration used items from PARCC, and the 2020 administration was disrupted by the COVID-19 pandemic.

[7] For the test score measures, we went as far back as a student's seventh-grade year to capture student test-taking and used the student's highest score if they took the same test multiple times by the time point of interest. For example, the Algebra 1 state assessment score for students in the class of 2017 would be the student's highest Algebra 1 score between 2012 and 2015 for the HSY2 measure and between 2012 and 2017 for the HSY4 measure.

Although our intent was to examine each measure considered, many of the measures were not available for most of the students in our study sample (see Exhibit T.4 in the Technical Appendix). In particular, Algebra 2 and Geometry PARCC scores did not exist for more than half of the students, even when looking across 4 years of high school, and ACT scores did not exist for more than 80% of the students. In addition, SAT scores are relevant for only the HSY4 time point. Even by the HSY4 time point, only about two thirds of students had an SAT score, and that rate was much lower for the 2021 cohort partly because of the COVID-19 pandemic and many colleges changing to test-optional admissions requirements. Similarly, the measures of advanced course success were limited for the HSY2 time point. Other potential measures of CCR, such as placement tests commonly used by community colleges, were not included in our analysis because they are not typically administered to students while they are in high school.

Given the data limitations for many of the potential measures and the *Blueprint*'s emphasis on assessing readiness by the end of a student's 10th-grade year, we restricted the analysis for the interim report to the following high school measures of CCR (see Exhibit C.4):

- English 10 state assessment scores
- Algebra 1 state assessment scores
- PSAT composite scores
- Overall HSGPA

Based on correlations among all the potential measures (see Technical Appendix Exhibit T.12), results for these four focal measures should reasonably capture the range of results we would expect from the broader set of potential measures. For example, the Algebra 1 state assessment scores are strongly correlated with Algebra 2 and Geometry state assessment scores, whereas the PSAT composite scores are strongly correlated with SAT and ACT scores. In addition, the overall HSGPA is strongly correlated with two other versions of HSGPA we considered: (a) HSGPA for academic subjects only and (b) HSGPA for core academic subjects only.

Exhibit C.4. Focal High School Measures of College and Career Readiness for the Predictive Validity Analysis

Type of measure	Measure	Description
Test score[a]	English 10 state assessment score	Scale score on the HSA Reading or PARCC English 10 assessment. We converted the HSA scores to PARCC-equivalent scores using the concordance table developed by MARC (2016).
Test score[a]	Algebra 1 state assessment score	Scale score on the HSA Algebra or PARCC Algebra 1 assessment. We converted the HSA scores to PARCC-equivalent scores using the concordance table developed by MARC (2016).
Test score	PSAT composite score	Sum of a student's highest PSAT math and PSAT reading scores on the NMSQT version of the PSAT. Prior to 2016, the PSAT was on a different scale and was not comparable to the current version. We converted the earlier PSAT scores to the current PSAT scale using concordance tables developed by the College Board (2016).
HSGPA	Overall GPA	We calculated a student's GPA by taking the sum of all grade points earned in every course a student took for a grade in the first 2 (or 4) years of high school and divided by the sum of all units attempted for a grade during the same time period.

Note. HSA = Maryland High School Assessment; HSGPA = high school grade point average; MARC = Maryland Assessment Research Center; MSDE = Maryland State Department of Education; NMSQT = National Merit Scholarship Qualifying Test; PARCC = Partnership for Assessment of Readiness for College and Careers. For additional details on the methodology adopted to calculate HSGPA, see Technical Appendix.

[a] Measure is part of the interim CCR standard.

C.4. Measures of Postsecondary Progress

To assess the quality of different high school measures of CCR, we examined how well the high school measures of CCR predicted progress toward postsecondary success. For this interim report, we examined two measures of postsecondary progress that focus on success in first-year credit-bearing college coursework: (a) the number of college course credits accumulated during PSY1 and (b) the GPA during PSY1. These two measures are available in the MLDS only for Maryland colleges with course credit data.

For the final report, we will expand the analysis to explore how well potential CCR measures perform for a broader group of students by including two additional measures of postsecondary progress that look at the stability of postsecondary college enrollment over 2 years: (a) retention at the same postsecondary institution from the first to the second year and (b) persistence in any postsecondary college pathway from the first to the second year. These two additional measures are available for all students whose initial postsecondary pathway begins with college enrollment, including in-state and out-of-state colleges. These measures—based on enrollment records—provide a more comprehensive view of students' progress

through the broader higher education system, which often includes transferring between postsecondary institutions (e.g., moving from a community college to a 4-year university, initially enrolling at an out-of-state university but returning to Maryland after one semester). In addition, maintaining postsecondary enrollment after the first year (i.e., persistence) is a leading indicator of college completion.

The measures of postsecondary progress, and the associated benchmarks we used to proxy "successful" progress, are in Exhibit C.5. Summary statistics for each measure are in the Technical Appendix by initial postsecondary pathway and student group (Exhibits T.7a–T.8b). For credit accumulation, we selected benchmarks that correspond to earning at least 12 or 15 credits per term, which means that a student successfully completed four or five 3-credit hour courses per term. We selected 12 credits as a benchmark because it is a credit-earning threshold typically used to determine satisfactory academic progress for federal financial aid purposes. We used 15 credits as an alternative benchmark because it corresponds with the average number of credits a student typically must earn per term to obtain a bachelor's degree in 4 years (eight semesters). For college GPA, we selected benchmarks that correspond to a cumulative GPA of 2.0, 2.5, and 3.0. We started with a 2.0 GPA benchmark because students are typically required to maintain at least a 2.0 GPA for federal financial aid purposes. We considered more stringent GPA benchmarks up to 3.0 (B average) because many of the related studies of CCR used a 3.0 college GPA as a marker for postsecondary success.

Exhibit C.5. Measures of Postsecondary Progress Included in the Predictive Validity Analysis

Measure	Description	Benchmarks
Credit accumulation	Cumulative number of postsecondary credits applicable toward a recognized postsecondary credential (e.g., certificate, degree) awarded to a student. Credits include both those earned at the reporting institution and at other postsecondary institutions (i.e., transfer-in credit).[a] Credit accumulation was measured at two time points: the postsecondary first year fall term (PSY1F) and the postsecondary first year spring term (PSY1S). Credits for the spring term represent the cumulative number of credits for the entire first year, not just the spring term.	• PSY1F credits ≥ 12 • PSY1F credits ≥ 15 • PSY1S credits ≥ 24 • PSY1S credits ≥ 30
College grade point average (GPA)	Cumulative GPA reported in the PSY1F and PSY1S terms within a student's first year of postsecondary enrollment.[b] Cumulative GPA for the spring term represents the cumulative GPA for the entire first year, not just the spring term.	• PSY1F GPA ≥ 2.0 • PSY1F GPA ≥ 2.5 • PSY1F GPA ≥ 3.0 • PSY1S GPA ≥ 2.0 • PSY1S GPA ≥ 2.5 • PSY1S GPA ≥ 3.0

[a] Credit accumulation would include postsecondary credits earned while in high school (e.g., dual enrollment, Advanced Placement), summer enrollment immediately following high school graduation, and postsecondary

enrollment at multiple institutions (e.g., taking one course at a community college while predominantly enrolled at a 4-year university), with the assumption that students submit their outside postsecondary credits earned to their postsecondary pathway institution. [b] GPA values are reported by a student's postsecondary institution; however, the data source does not indicate the number of college credits and whether those credits were attempted or earned when deriving the GPA. In practice, transfer-in credits typically are not included in a student's college GPA (i.e., only credits earned at the reporting institution apply to an institution-reported GPA).

C.5. Data Analysis

To address the predictive validity analysis research questions, we used a combination of descriptive, correlational, and classification statistical methods.

Analysis for Research Question 1: How should high school measures of CCR be operationalized to best predict whether students will be successful in entry-level credit-bearing coursework?

For the first research question, we examined how the measures are distributed across students and correlated among each other. In addition, we estimated the relationship between the high school measures of CCR (predictors or independent variables) and the measures of postsecondary progress (criterion or dependent variables). Details about the statistical methods used to address the first research question are in the Technical Appendix.

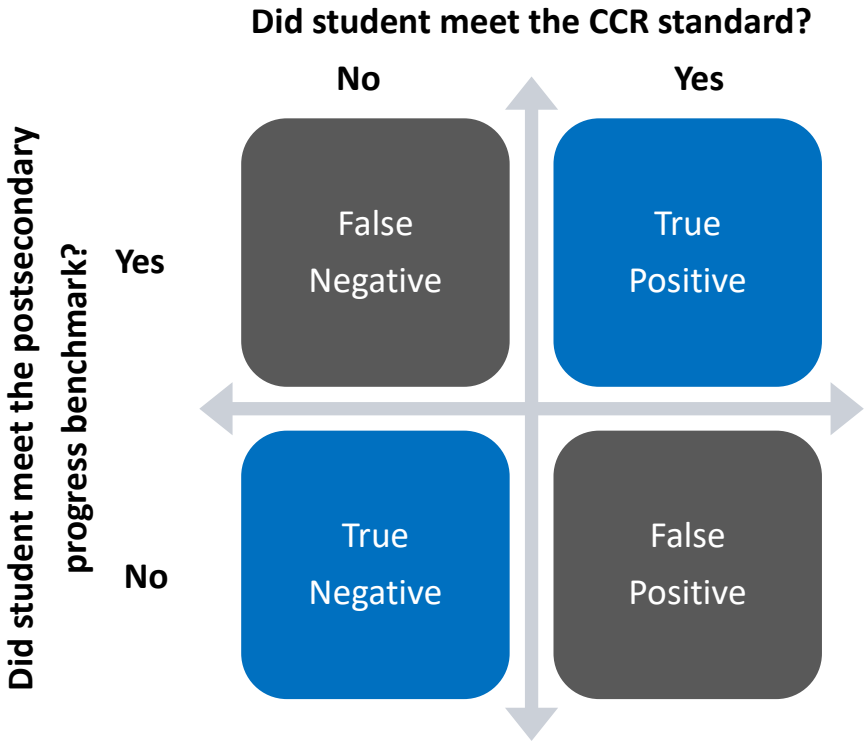
Analysis for Research Question 2: How well does Maryland's interim CCR standard predict student success in entry-level credit-bearing coursework?

For the second research question, we assessed the validity of the standard as an instrument for identifying (or screening) students who are or are not on track for CCR. Our analysis uses metrics of classification accuracy and error to understand how well the dichotomous indicator of readiness at the end of HSY2 predicts different dichotomous benchmarks of postsecondary progress during the first year after expected high school graduation. With this approach, we categorized students into one of four conditions (see Exhibit C.6) based on whether they met the CCR standard at a particular time in high school and whether they achieved the postsecondary progress benchmark during their first postsecondary year (PSY1):

- A **true positive (TP)** prediction is when the standard indicates a student is ready and the student did meet the postsecondary progress benchmark (i.e., the standard correctly predicted postsecondary progress).
- A **true negative (TN)** prediction is when the standard indicates that a student is not ready and the student did not meet the postsecondary progress benchmark (i.e., the standard correctly predicted a postsecondary delay).
- A **false positive (FP)** prediction is when the standard indicates that a student is ready, but the student did not meet the postsecondary progress benchmark (i.e., the standard incorrectly predicted postsecondary progress).

- A **false negative (FN)** prediction is when the standard indicates that a student is not ready, but the student did meet the postsecondary progress benchmark (i.e., the standard incorrectly predicted a postsecondary delay).

Exhibit C.6. The Classification Approach for a Dichotomous College and Career Ready Standard and a Dichotomous Postsecondary Progress Benchmark



The predictive validity metrics we focus on are summary statistics based on the four classification types:

- The accuracy rate is the probability of correctly identifying a student as ready or not ready to make postsecondary progress: $\frac{TP + TN}{TP + TN + FP + FN}$
- The sensitivity rate is the probability of correctly identifying students who are truly ready to make postsecondary progress: $\frac{TP}{TP + FN}$
- The specificity rate is the probability of correctly identifying students who are truly not ready to make postsecondary progress: $\frac{TN}{TN + FP}$

We calculated each predictive validity metric using different postsecondary progress benchmarks. In addition, we calculated the metrics for the overall student sample as well as different student groups and initial postsecondary pathways. For simplicity of presentation and interpretation, we focus on the accuracy rate because it provides an overall picture of a

standard's validity. However, the accuracy rate can change depending on how common (or rare) it is for a student to meet a given benchmark, which may distort comparisons across postsecondary benchmarks or across student groups.

The sensitivity and specificity rates provide a more detailed picture of a standard's validity and are more appropriate for comparisons between postsecondary benchmarks and student groups. In addition, the sensitivity and specificity rates are important metrics when considering the practical trade-offs of incorrectly identifying a student as not ready when they truly are (Type II error = 1 – the sensitivity rate) or incorrectly identifying a student as ready when they truly are not ready (Type I error = 1 – the specificity rate). While there are no established standards for what level of accuracy, sensitivity, and specificity is appropriate for an indicator of CCR, rates of at least 70% are typically desired for diagnostic or screening instruments used to identify students for academic interventions (National Center on Intensive Intervention & National Center on Improving Literacy, n.d.).

Analysis for Research Question 3: How well do alternative CCR standards predict student success in entry-level credit-bearing coursework?

For the third research question, we assessed the validity of different standards following the same approach as described for the interim CCR standard under the second research question. For the interim report, we focused the analysis on three alternative standards defined at the end of a student's HSY2:

- Alternative 1 = Interim CCR standard or a PSAT composite score threshold
- Alternative 2 = Interim CCR standard or an overall HSGPA threshold
- Alternative 3 = Interim CCR standard or a PSAT composite score threshold or an overall HSGPA threshold

For the final report, we will adjust the alternative standards we test based on the findings related to the first research question, discussions with MSDE, and information gathered as part of the standards and alignment analysis.

Analysis for Research Question 4: How well do potential CCR standards and the high school measures of CCR predict postsecondary progress along different types of postsecondary pathways?

For the fourth research question, we disaggregated results for the first three research questions by initial postsecondary pathways and described meaningful differences.

Analysis for Research Question 5: To what extent do the potential CCR standards and high school measures of CCR perform equitably across policy-relevant student groups?

For the fifth research question, we disaggregated results for the first three research questions by policy-relevant student groups and described meaningful differences.

D. Description of High School Measures of College and Career Readiness

In this section, we address the first research question by describing key properties of the high school CCR measures, including how they are related to measures of postsecondary progress. We focus the discussion on four measures available for most students at the end of HSY2: English 10 state assessment score, Algebra 1 state assessment score, PSAT composite score, and overall HSGPA. The results presented in this section provide information about useful ways to operationalize the readiness measures for a CCR standard.

D.1. How Are the Scores Distributed Across Students?

To understand the potential implications of operationalizing high school measures of CCR for a CCR standard, it is important to consider how the underlying measures are distributed across and within student groups. Exhibits D.1a and D.1b present the range of scores at the HSY2 time point for the English 10 state assessment, by initial postsecondary pathway and student group, respectively. The exhibits show the 10th to 90th percentile range (gray bars) and the 25th to 75th percentile range (dark blue bars) for students' scores. The median, or 50th percentile, is represented by a light blue diamond. In addition, the exhibits report the mean scores, the standard deviation, and the percentage of students without a score (missing rate; see sidebar about missing data). Parallel information for the Algebra 1 state assessment, PSAT composite, and overall HSGPA measures is in the Technical Appendix (Exhibits T.9a–T.11b).

The distributions of all four CCR measures show important variability in performance between student groups, as well as substantive variability among students within the same

A Cautionary Note About Missing Data

The missing data rates for each measure and student group (see Exhibit D.1 and Exhibits T.9a–T.11b in the Technical Appendix) are important to consider when interpreting the results and comparing scores across groups because high (or higher) missing rates could signal systematic differences in student readiness (e.g., underprepared students not taking a test) or opportunities (e.g., some students not given the opportunity to take a test) that are hidden when just looking at students with available scores.

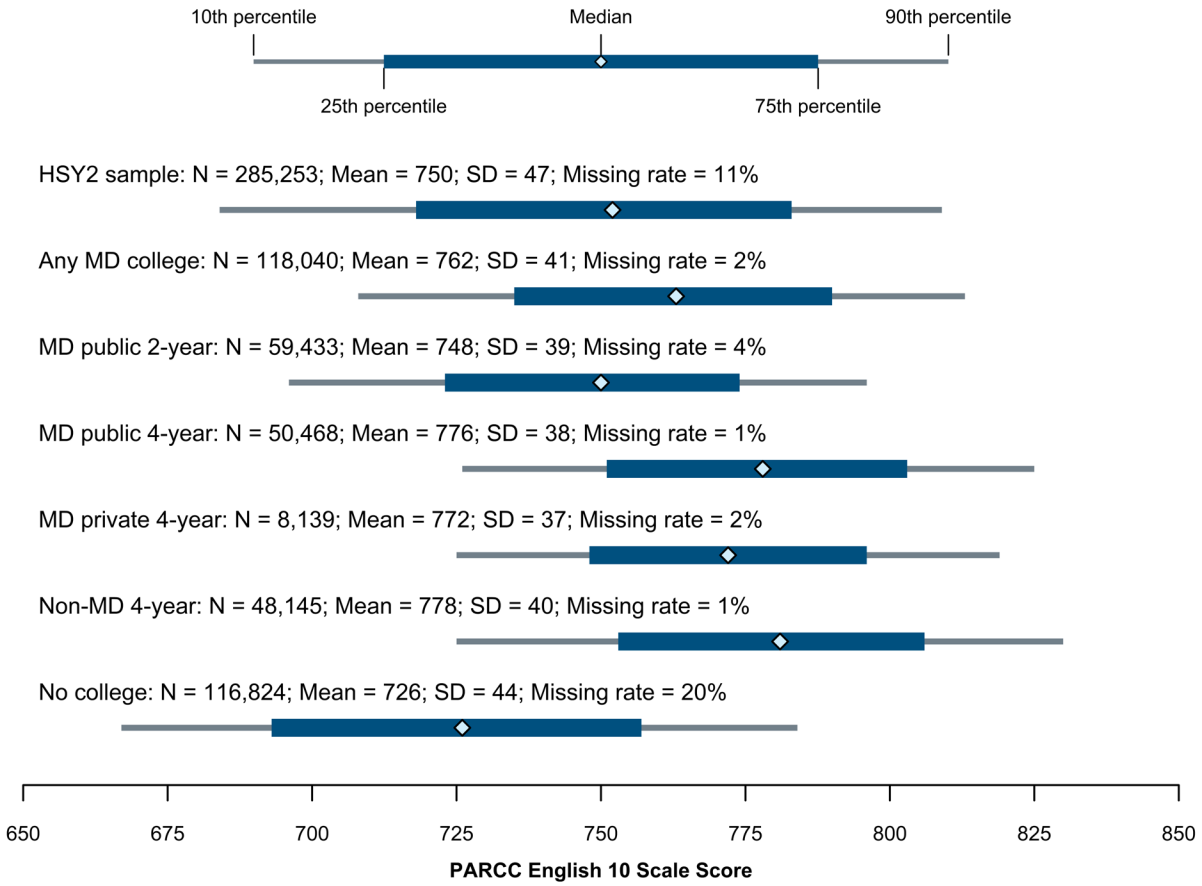
When missing data rates are high (e.g., greater than 10%), the reported distributions and averages may be inaccurately inflated.

Across the four focal high school measures of CCR, the percentage of students in our sample missing data at the HSY2 time point ranges from 4% (HSGPA) to 28% (PSAT). At the HSY4 time point, the missing data rate ranges from 3% to 19%.

group. As illustrated in Exhibit D.1a, the average English 10 test score for students who attended a Maryland 2-year college was about 28 points lower than for students who attended a Maryland 4-year college (more than half a standard deviation difference). However, within both student groups are students with low and high English 10 scores, with almost a quarter of the 2-year college students scoring higher than the average 4-year college student and about a quarter of the 4-year college students scoring lower than the average 2-year college student.

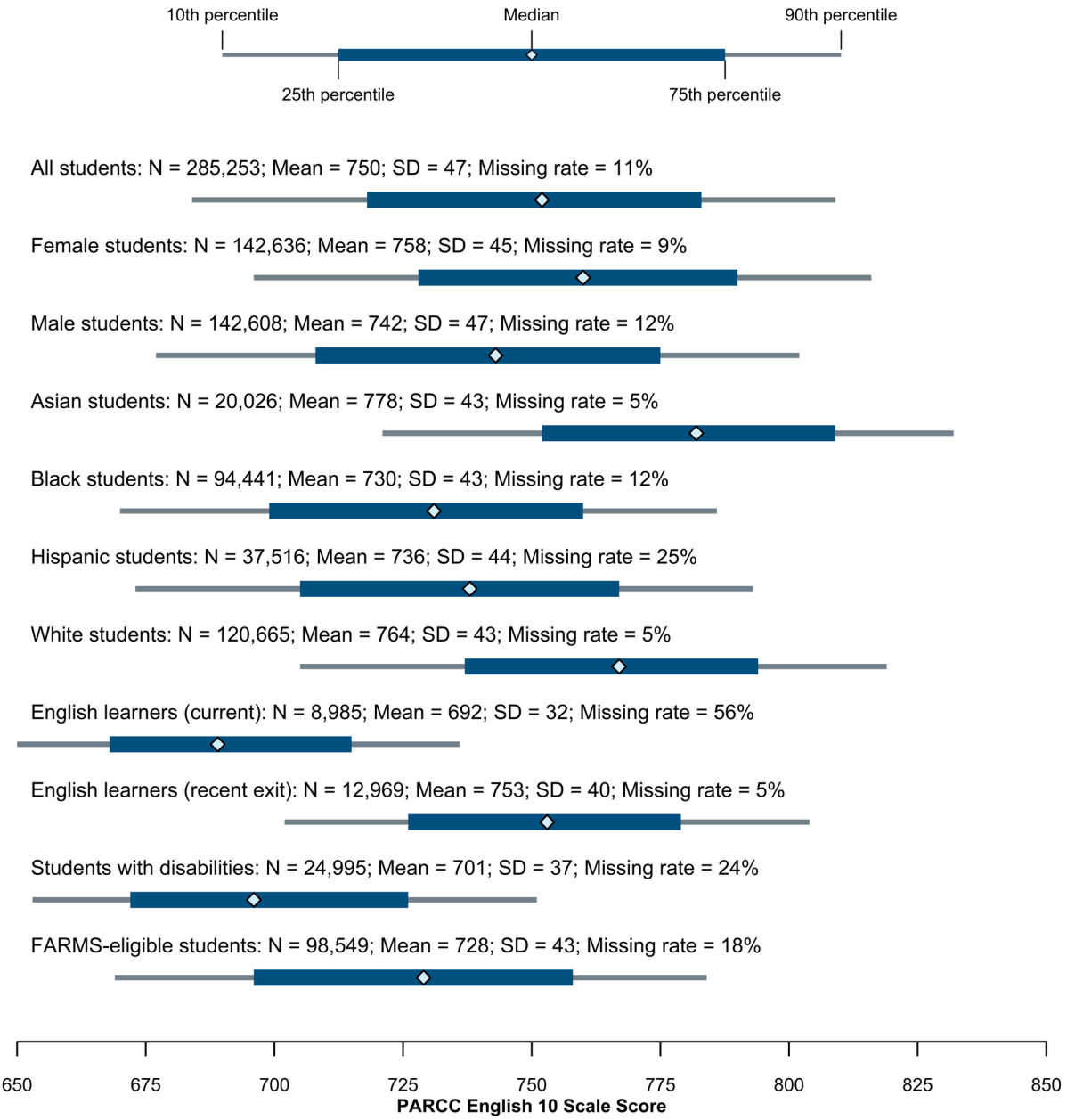
Including certain measures in the CCR standard may raise equity concerns for student groups with systematically high missing data rates and score distributions well below the state average. For example, slightly more than half of the students (56%) classified as ELs in HSY2 did not take the English 10 test in HSY2, which is understandable if they were in an English language development course instead of English 10. Similarly, about a quarter of students with disabilities (24%) did not take the English 10 test, which might be explained by their taking an alternative assessment.

Exhibit D.1a. Distribution of English 10 Scores at End of HSY2, by Initial Postsecondary Pathway



Note. HSY = high school year; MD = Maryland; PARCC = Partnership for Assessment of Readiness for College and Careers.

Exhibit D.1b. Distribution of English 10 Scores at End of HSY2, by Student Group



Note. FARMS = free and reduced-price meal services; HSY = high school year; PARCC = Partnership for Assessment of Readiness for College and Careers.

D.2. How Are the High School Measures of College and Career Readiness Related to Postsecondary Progress?

A high school measure should be part of a CCR standard only if the measure is associated with (or predictive of) important measures of postsecondary progress. To gauge the extent to which the four focal high school measures of CCR are predictive of postsecondary progress, we estimated the strength of the relationship (R^2) between each individual CCR measure and two measures of postsecondary progress: college credits awarded in the fall of the first postsecondary year and college GPA in the fall of the first postsecondary year.[8] Because the measures of postsecondary progress are available only for those students who enrolled in a Maryland college, this analysis is restricted to students in one of the three Maryland college postsecondary pathways (2-year public colleges, 4-year private colleges, and 4-year private colleges). To better understand the nature of these relationships, we also estimated the probability that a student would meet different benchmarks of postsecondary progress based on how the student scored on an individual high school measure of CCR.

The estimated strength of each relationship is in the Technical Appendix (Exhibits T.13a–T.13c). Across all students with an initial postsecondary pathway in a Maryland college, all four high school measures of CCR at the end of a student's HSY2 were positively related to college credits awarded, with the PSAT composite score being the strongest individual predictor ($R^2 = 30\%$). The relationships were weaker for college GPA, with overall HSGPA being the strongest predictor ($R^2 = 28\%$). However, the strength of the relationships differed depending on a student's initial postsecondary pathway. In particular, the high school measures of CCR were more predictive of postsecondary progress for students in 4-year colleges than 2-year colleges. The Algebra 1 measure, as an example, explained 27% of the variation in college credits awarded at a Maryland public 4-year college but only 15% of the variation at a Maryland public 2-year college.

Disaggregating the results for student groups reveals that the high school measures of CCR are better predictors of postsecondary progress for some student groups than for others. The measures have the weakest relationship when predicting college credits awarded for Black students, ELs, and students with disabilities. Specifically, the weakest relationships are between the state assessment and PSAT measures and college GPA for ELs and students with disabilities.

[8] We focused on postsecondary progress in the fall semester instead of the fall and spring semesters because student mobility and dropout between the fall and spring semesters could skew results based on the spring semester.

To better understand the predictive power of high school measures of CCR, it is useful to look at how well they jointly predict postsecondary progress. To do this, we estimated a series of multivariate linear regression models to see how the percentage of variance explained (adjusted R^2) changes based on different combinations of measures. Overall, the results show a small increase in the ability to predict postsecondary progress when including PSAT and/or HSGPA in a model with the English 10 and Algebra 1 state assessment scores (see Technical Appendix Exhibits T.14a–T.14c). For every student group and postsecondary pathway, using information from all four high school measures of CCR in one model provided the best prediction of postsecondary progress.

E. Predictive Validity of the Interim CCR Standard

In this section, we address the second research question by describing how well the interim CCR standard predicts postsecondary progress when applied to the student cohorts in our analysis sample. We focus the discussion on the accuracy of making a CCR designation at the end of a student's HSY2. The results presented in this section provide information about the quality of the interim CCR standard.

E.1. How Many Students Would Have Met the Interim CCR Standard at the End of Their Second Year of High School?

Before addressing the accuracy of the interim CCR standard in predicting postsecondary progress, it is useful to understand how many students would have met the standard if it was applied to them at the end of their HSY2. To meet the interim CCR standard, a student must meet or exceed the following criteria for both English and math:

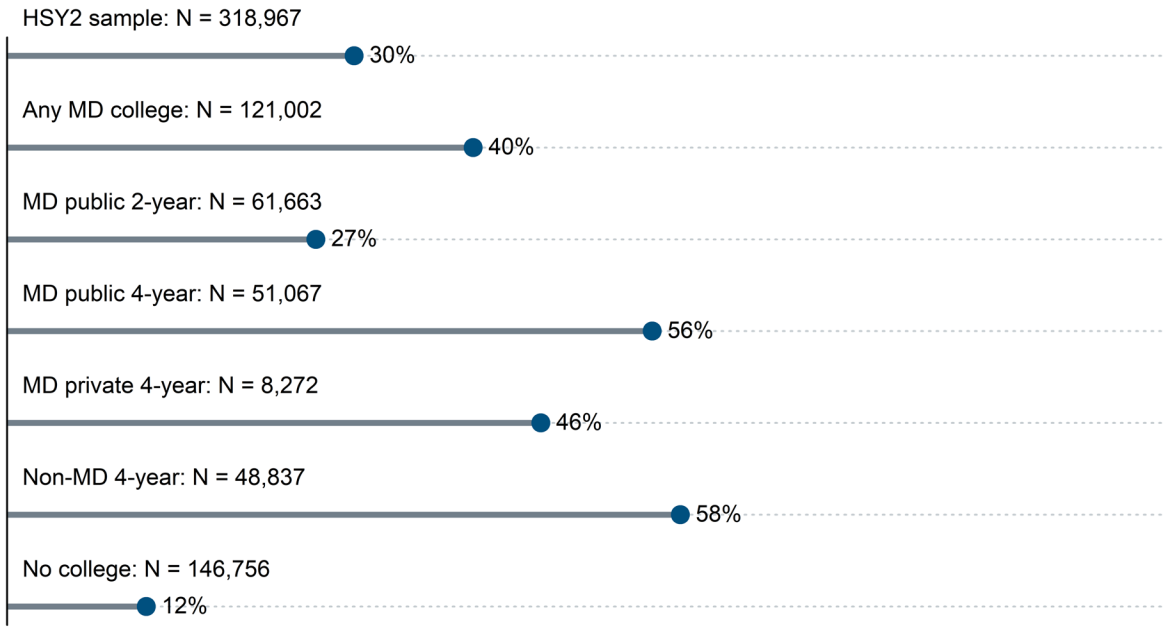
- **English**: Score at or above the proficient (or met expectations) performance level on the English 10 state assessment (a score of at least 750 on the PARCC English 10 test).
- **Math**: Score at or above the proficient (or met expectations) performance level on the Algebra 1, or Algebra 2, or Geometry state assessment (a score of at least 750 on the PARCC test) or score at least 520 on the SAT math test.

Exhibit E.1a presents the readiness rates by initial postsecondary pathway, and Exhibit E.1b presents the readiness rates by student group.

Overall, 30% of the students in our sample would have met the interim CCR standard by the end of their HSY2, with 40% of students who were in one of the three Maryland college postsecondary pathways meeting the interim CCR standard. The rate was lower (27%) for students who went to a Maryland 2-year college and higher (56%) for students who went to a

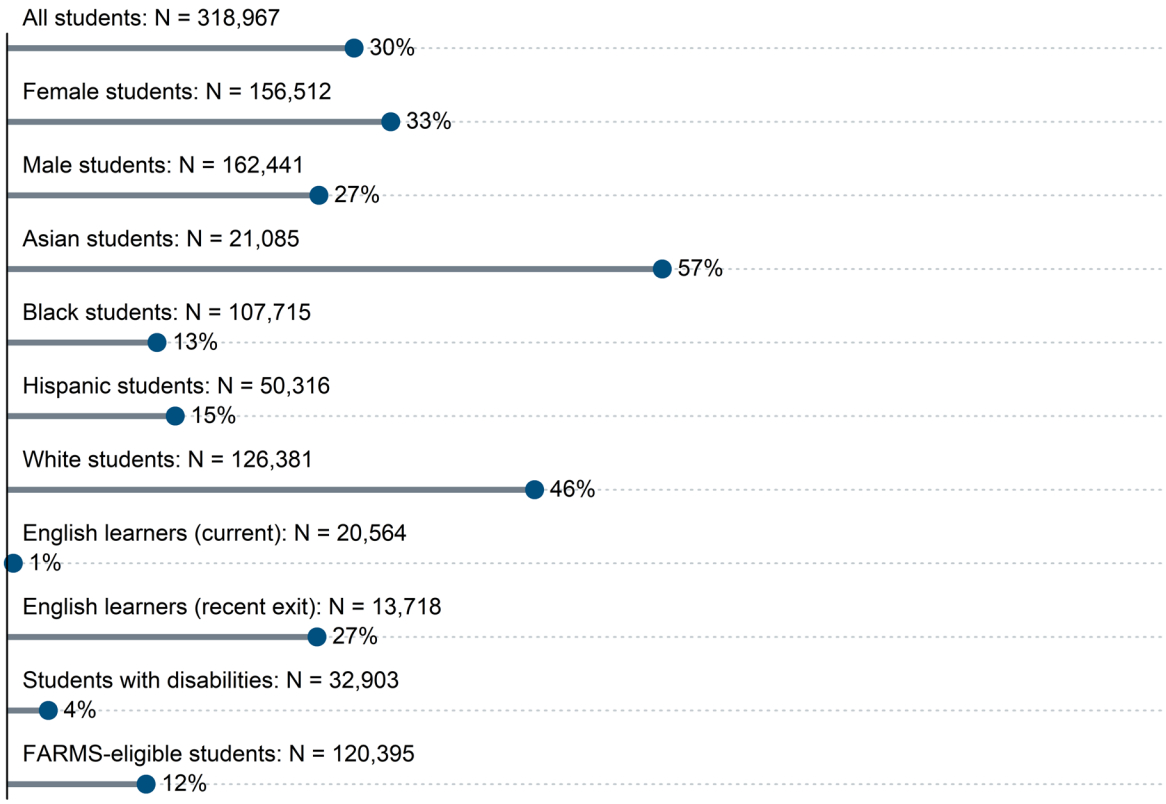
Maryland public 4-year college. Large differences in the rates exist across students. For example, the rates for Black and Hispanic students are only 13% and 15%, respectively, and the rate for current ELs and students with disabilities is less than 5%.

Exhibit E.1a. Percentage of Students Who Met the Interim CCR Standard, by Initial Postsecondary Pathway



Note. CCR = college and career ready; HSY = high school year; MD = Maryland.

Exhibit E.1b. Percentage of Students Who Met the Interim CCR Standard by Student Characteristics



Note. CCR = college and career ready; FARMS = free and reduced-price meal services.

E.2. How Accurate Is the Interim CCR Standard at Predicting Postsecondary Progress?

An important indicator of a standard's quality is how well it can correctly predict which students will experience postsecondary progress and which students will not. The accuracy rate is a key statistic that summarizes the percentage of students who would be correctly classified as ready to make postsecondary progress or not ready based on a definition of successful postsecondary progress. The analysis of accuracy rates is restricted to students in one of the three Maryland college postsecondary pathways. The interim CCR standard accuracy rates for predicting benchmarks of college credits awarded are in Exhibit E.2. The accuracy rates for predicting benchmarks of college GPA are in Exhibit E.3. Generally, accuracy rates of at least 70% are desired, with higher rates if the interim CCR standard is to be used for consequential decision making.

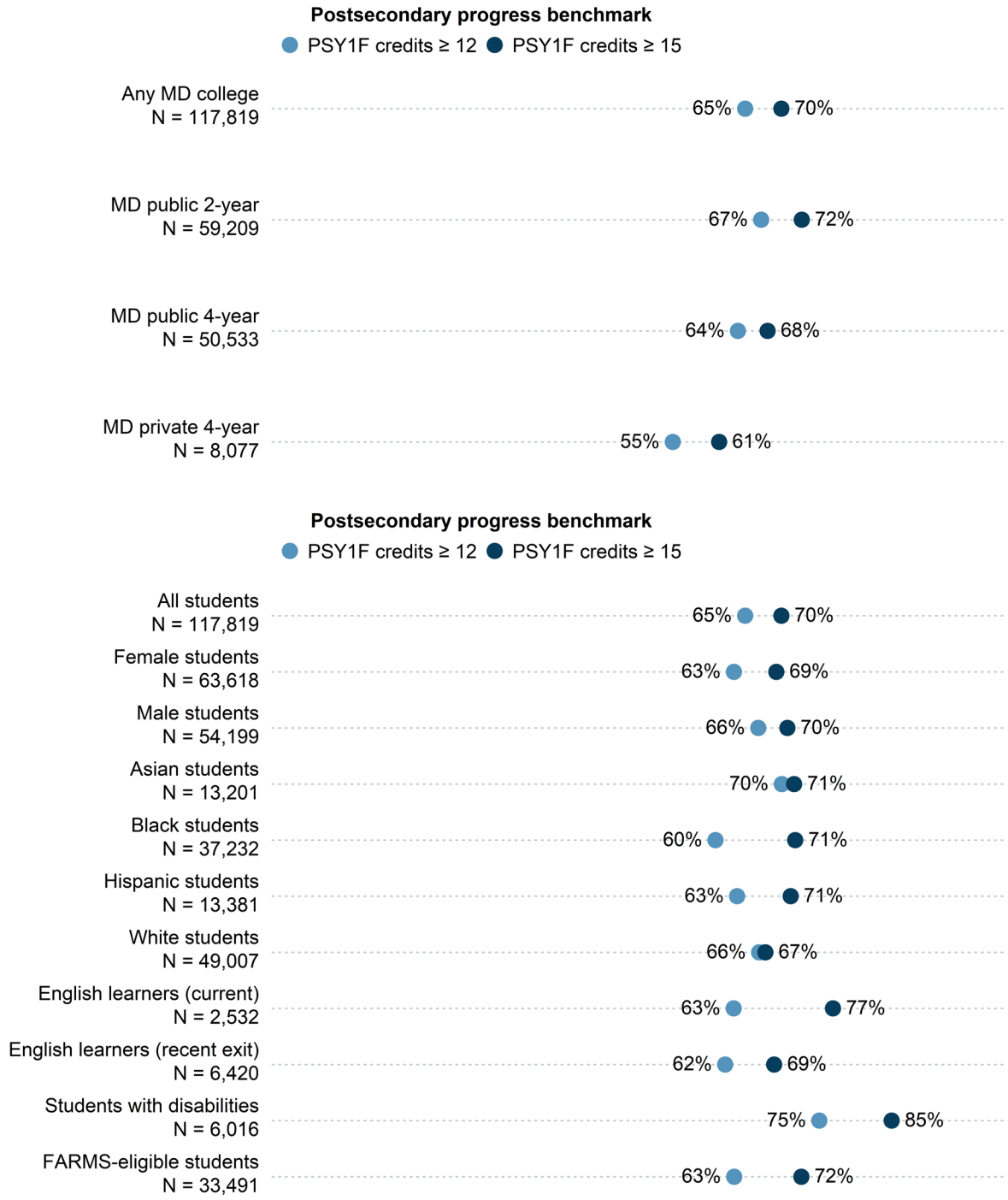
Overall, the interim CCR standard accurately classified (a) 65% of students based on the benchmark of at least 12 credits awarded and (b) 70% of students based on the benchmark of

at least 15 credits awarded. For example, the accuracy rate for the 12-credit benchmark is 65% because 35% of the students met the interim CCR standard and had at least 12 college credits in PSY1F (a true positive prediction), plus 30% of the students did not meet the interim CCR standard and had less than 12 college credits in PSY1F (a true negative prediction). The accuracy rates were similar across initial postsecondary pathways, although slightly higher for the Maryland 2-year college pathway and slightly lower for the Maryland private 4-year pathway. In addition, the accuracy rates were relatively similar across student groups, with some exceptions. Defining postsecondary progress based on at least 12 credits versus 15 credits has greater implications for accurately classifying CCR among Black students, Hispanic students, current ELs, students with disabilities, and FARMS-eligible students, than for other groups. For example, using the interim CCR standard correctly classified 63% of FARMS-eligible students using the 12-credit benchmark but 72% of FARMS-eligible students using the 15-credit benchmark.

When college GPA is used to define postsecondary progress, the interim CCR standard's accuracy rates are lower than when using college credits for postsecondary progress. Overall, the interim CCR standard accurately classified 56%–64% of students based on college GPA, depending on which GPA benchmark was used. If postsecondary progress is defined as obtaining a college GPA of at least 2.0, the interim CCR standard is a particularly poor way to accurately classify students who go to a Maryland 2-year college (accuracy rate = 51%). In addition, using the PSY1F GPA ≥ 2.0 postsecondary progress benchmark resulted in accuracy rates below 50% for many of the student subgroups.

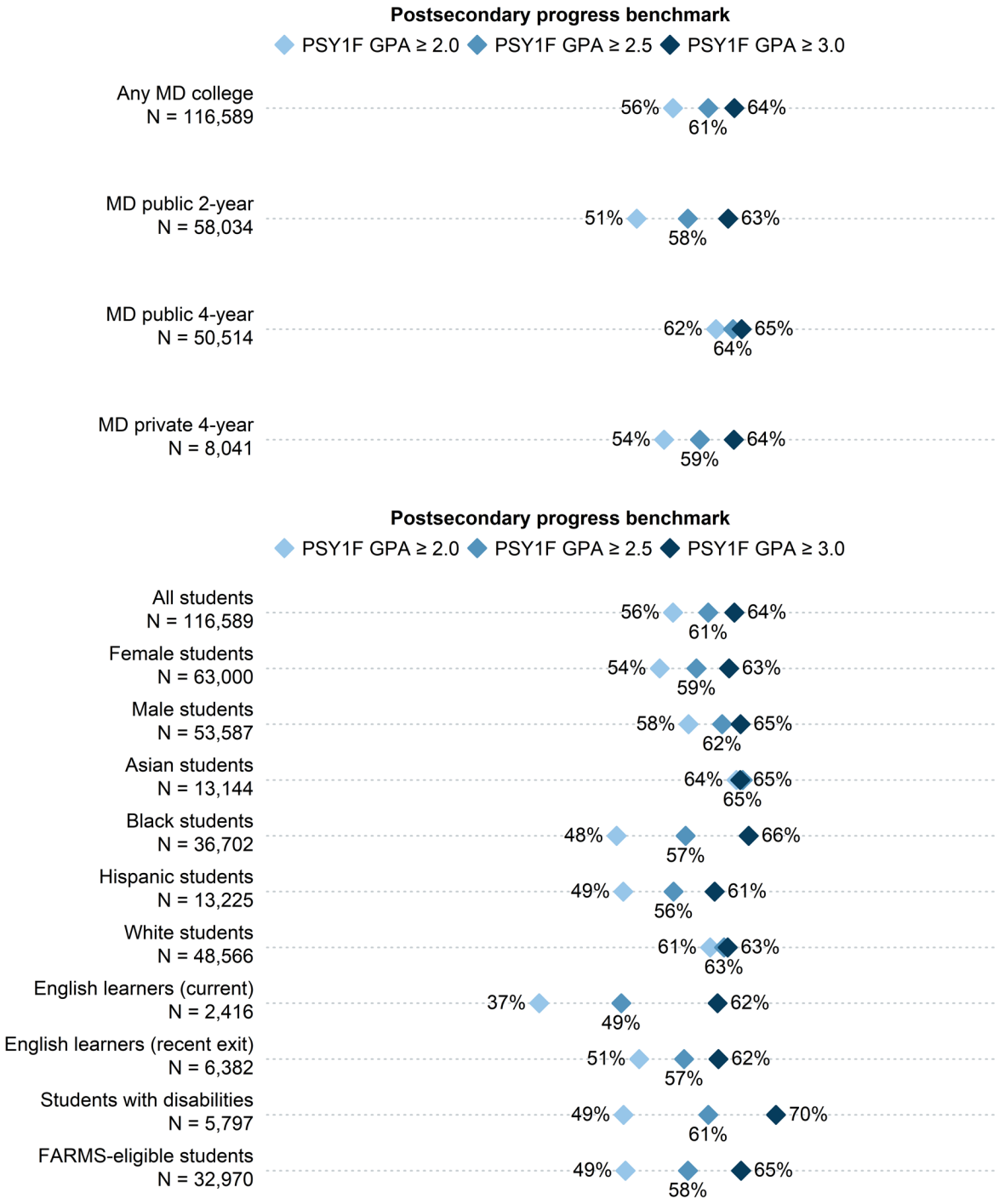
The sensitivity and specificity rates for the interim CCR standard provide more insight into the classification accuracy (see Exhibit T.16a in the Technical Appendix). The interim CCR standard has relatively high specificity rates (between 73% and 83% depending on the postsecondary progress benchmark), which indicates it does a good job identifying students who are not ready to make postsecondary progress. However, the interim CCR standard has relatively low sensitivity rates (between 48% and 61%), which indicates it does a poor job identifying students who are ready to make postsecondary progress. In other words, using the interim CCR standard could result in classifying a lot of students as not ready who really are ready for college.

Exhibit E.2. Accuracy Rates for the Interim CCR Standard Predicting Postsecondary Year 1 Fall Credits Awarded, by Initial Postsecondary Pathway and Student Characteristics



Note. CCR = college and career ready; FARMS = free and reduced-price meal services; MD = Maryland; PSY1F = postsecondary first-year fall term.

Exhibit E.3. Accuracy Rates for the Interim CCR Standard Predicting Postsecondary Year 1 Fall GPA, by Initial Postsecondary Pathway and Student Characteristics



Note. CCR = college and career ready; FARMS = free and reduced-price meal services; MD = Maryland; PSY1F = postsecondary first-year fall term.

F. Predictive Validity of Alternative CCR Standards

In this section, we address the third research question by describing how well three alternative CCR standards predict postsecondary progress relative to the interim CCR standard. We focus the discussion on the accuracy of making a CCR designation at the end of a student's HSY2. The analysis is restricted to students in one of the three Maryland college postsecondary pathways. The results presented in this section provide information about ways to improve upon the predictive validity of the interim CCR standard.

We considered the following three alternative CCR standards:

- Alternative 1: Meeting the interim CCR standard or a PSAT composite score ≥ 1000
- Alternative 2: Meeting the interim CCR standard or an overall HSGPA ≥ 3.0
- Alternative 3: Meeting the interim CCR standard or a PSAT composite score ≥ 1000 or an overall HSGPA ≥ 3.0

We selected these three alternative specifications of the CCR standard because our analysis of the relationship between the high school measures of CCR and postsecondary progress measures (discussed in Section D) indicated that combining the PSAT and the HSGPA with the state assessment scores could improve predictions of postsecondary progress. We selected a PSAT threshold of 1000 and a HSGPA threshold of 3.0 because those values roughly correspond to the point at which students have a 50% likelihood of meeting postsecondary progress benchmarks (see Exhibits T.15a and T.15b in the Technical Appendix). In addition, the PSAT threshold of 1000 roughly aligns with the interim CCR standard criterion of an SAT math score of 520, and the HSGPA threshold of 3.0 has been used in prior research. In the Technical Appendix (see Exhibit T.17), we provide information about how the predictive validity of the alternative CCR standards changes with different PSAT and HSGPA thresholds.

F.1. How Many Students Would Have Met Alternative CCR Standards at the End of Their Second Year of High School?

Compared with the interim CCR standard, the alternative CCR standards provide more ways in which students can meet the CCR standard. As expected, the percentage of students who would meet an alternative CCR standard was greater than under the interim CCR standard. The percentage of students who would meet each CCR standard is in Exhibit F.1a by initial postsecondary pathway and Exhibit F.1b by student group.

Exhibit F.1a. Percentage of Students Who Met the Alternative CCR Standards, by Initial Postsecondary Pathway

	Interim Standard	Alt 1 Standard	Alt 2 Standard	Alt 3 Standard
HSY2 sample	30%	35%	49%	50%
Any MD college	40%	47%	64%	66%
MD public 2-year	27%	31%	49%	52%
MD public 4-year	56%	65%	80%	82%
MD private 4-year	46%	53%	78%	79%
Non-MD 4-year	58%	68%	82%	84%
No college	12%	14%	25%	26%

Note. Alternative 1 includes an option to meet the standard with a PSAT composite score ≥ 1000. Alternative 2 includes an option to meet the standard with an overall high school grade point average (HSGPA) ≥ 3.0. Alternative 3 includes the PSAT option and the HSGPA option. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages. CCR = college and career ready. HSY = high school year; MD = Maryland.

Exhibit F.1b. Percentage of Students Who Met the Alternative CCR Standards, by Student Characteristics

	Interim Standard	Alt 1 Standard	Alt 2 Standard	Alt 3 Standard
All students	30%	35%	49%	50%
Female students	33%	38%	56%	57%
Male students	27%	32%	42%	44%
Asian students	57%	66%	82%	84%
Black students	13%	16%	29%	30%
Hispanic students	15%	17%	36%	37%
White students	46%	53%	64%	66%
English learners (current)	1%	1%	30%	30%
English learners (recent exit)	27%	31%	56%	57%
Students with disabilities	4%	5%	19%	20%
FARMS-eligible students	12%	14%	28%	29%

Note. Alternative 1 includes an option to meet the standard with a PSAT composite score ≥ 1000. Alternative 2 includes an option to meet the standard with an overall high school grade point average (HSGPA) ≥ 3.0. Alternative 3 includes the PSAT option and the HSGPA option. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages. CCR = college and career ready; FARMS = free and reduced-price meal services.

Overall, an additional 5% of students (from 30% to 35%) would meet the standard if the PSAT option was included, and an additional 19% of students (from 30% to 49%) would meet the standard if the HSGPA option was included. Including both a PSAT and an HSGPA option (Alternative 3) does not meaningfully increase the percentage of students meeting the standard beyond just adding an HSGPA option (Alternative 2). The increase in students meeting the standard when including an HSGPA option is relatively consistent for each initial postsecondary pathway and student group.

Including an HSGPA option may be particularly salient for current ELs and students with disabilities. For current ELs, only 1% would meet the interim CCR standard, whereas 30% would meet the CCR standard if the HSGPA option was available. Similarly, for students with disabilities, only 4% would meet the interim CCR standard, whereas 19% would meet it if the HSGPA option was available.

F.2. How Accurate Are the Alternative CCR Standards at Predicting Postsecondary Progress?

To examine whether the alternative CCR standards improve upon the interim CCR standard's ability to predict postsecondary progress, we compared the accuracy rates of each standard. The analysis of accuracy rates is restricted to students in one of the three Maryland college postsecondary pathways. The rates for each initial postsecondary pathway are in Exhibit F.2a, and the rates for each student group are in Exhibit F.2b. We report the accuracy rates for predicting two of the postsecondary progress benchmarks: (a) at least 12 college credits awarded and (b) a college GPA of at least 2.0. These two benchmarks represent the lower end of the accuracy estimates for the CCR standards. The comparative differences between standards are similar for the other postsecondary progress benchmarks (see Exhibit T.8a in the Technical Appendix).

Overall, each alternative CCR standard was more accurate than the interim CCR standard, with standards including HSGPA having the highest accuracy rate (75% for college credits and 72% for college GPA). Including PSAT in a CCR standard with HSGPA (Alternative 3) did not substantively improve the accuracy rate compared with a CCR standard with HSGPA (Alternative 2). However, the alternative standard with just a PSAT option (Alternative 1) had slightly higher accuracy rates than the other alternatives when using college credits of at least 15 as the postsecondary progress benchmark (see Exhibit T.8a in the Technical Appendix). Including HSGPA was particularly helpful for the 4-year college pathways. For example, the accuracy rate for the college credits benchmark at Maryland public 4-year colleges improved from 64% with the interim CCR standard to 81% with the Alternative 2 CCR standard. At Maryland public 2-year colleges, the accuracy rate improved only 2 percentage points, from 67% to 69%.

Exhibit F.2a. Accuracy Rates for the Alternative CCR Standards Predicting Postsecondary Progress, by Postsecondary Pathway

Postsecondary Progress Benchmark: PSY1F Credits Awarded ≥ 12

	Interim Standard	Alt 1 Standard	Alt 2 Standard	Alt 3 Standard
Any MD college	65%	68%	75%	75%
MD public 2-year	67%	68%	69%	69%
MD public 4-year	64%	71%	81%	82%
MD private 4-year	55%	60%	79%	79%

Postsecondary Progress Benchmark: PSY1F GPA ≥ 2.0

	Interim Standard	Alt 1 Standard	Alt 2 Standard	Alt 3 Standard
Any MD college	56%	60%	72%	72%
MD public 2-year	51%	53%	64%	64%
MD public 4-year	62%	68%	79%	80%
MD private 4-year	54%	60%	78%	78%

Note. Alternative 1 includes an option to meet the standard with a PSAT composite score ≥ 1000. Alternative 2 includes an option to meet the standard with an overall high school grade point average (HSGPA) ≥ 3.0. Alternative 3 includes the PSAT option and the HSGPA option. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher accuracy rates. CCR = college and career ready; MD = Maryland; PSY1F = postsecondary first-year fall term.

Exhibit F.2b. Accuracy Rates for the Alternative CCR Standards Predicting Postsecondary Progress, by Student Characteristics

Postsecondary Progress Benchmark: PSY1F Credits Awarded ≥ 12

	Interim Standard	Alt 1 Standard	Alt 2 Standard	Alt 3 Standard
All students	65%	68%	75%	75%
Female students	63%	67%	76%	76%
Male students	66%	70%	74%	74%
Asian students	70%	77%	83%	83%
Black students	60%	63%	70%	70%
Hispanic students	63%	66%	70%	70%
White students	66%	71%	78%	78%
English learners (current)	63%	64%	64%	64%
English learners (recent exit)	62%	65%	73%	73%
Students with disabilities	75%	75%	71%	71%
FARMS-eligible students	63%	65%	70%	70%

Postsecondary Progress Benchmark: PSY1F GPA ≥ 2.0

	Interim Standard	Alt 1 Standard	Alt 2 Standard	Alt 3 Standard
All students	56%	60%	72%	72%
Female students	54%	58%	73%	74%
Male students	58%	62%	70%	70%
Asian students	64%	72%	83%	84%
Black students	48%	50%	63%	63%
Hispanic students	49%	52%	67%	67%
White students	61%	66%	76%	77%
English learners (current)	37%	38%	65%	65%
English learners (recent exit)	51%	54%	74%	74%
Students with disabilities	49%	50%	60%	60%
FARMS-eligible students	49%	51%	65%	65%

Note. Alternative 1 includes an option to meet the standard with a PSAT composite score ≥ 1000. Alternative 2 includes an option to meet the standard with an overall high school grade point average (HSGPA) ≥ 3.0. Alternative 3 includes the PSAT option and the HSGPA option. Lighter versus darker color shading in the exhibit

distinguishes between lower versus higher accuracy rates. CCR = college and career ready; FARMS = free and reduced-price meal services; PSY1F = postsecondary first-year fall term.

Adding HSGPA into the CCR standard also improved the accuracy rate for many student groups. For the college credits benchmark, the accuracy rate for only two of the 10 student groups examined was at least 70% with the interim CCR standard, but the accuracy rate for nine of the 10 student groups was at least 70% with the Alternative 2 CCR standard. The exception was the accuracy rate for current ELs. Adding HSGPA did not improve the accuracy rate for students with disabilities. For the college GPA benchmark, including HSGPA led to more pronounced improvements in accuracy for some student groups. Accuracy rates for the following groups went from less than 50% with the interim CCR standard to more than 60% with the Alternative 2 standard: Black students, Hispanic students, current ELs, students with disabilities, and FARMS-eligible students.

Relying solely on the accuracy rate masks some differences in performance between the interim CCR standard and the alternative standards. It is important to also consider the sensitivity rate (how well the standard correctly identifies students making progress) and the specificity rate (how well the standard correctly identifies students not making progress) to understand differences in predictive validity across alternative CCR standards. Ideally, a quality CCR standard should have both sensitivity and specificity rates of at least 70%. The sensitivity and specificity rates for each CCR standard and each postsecondary progress benchmark are in the Technical Appendix (Exhibits T.16a–T.16d).

Overall, none of the CCR standards have sensitivity and specificity rates of more than 70%. Rather, the two standards based only on test scores (interim CCR standard and Alternative 1) have higher specificity rates than sensitivity rates. Thus, these two standards can do a good job of identifying students who are not ready to make postsecondary progress but will misclassify a higher percentage of students who are ready to make postsecondary progress. Conversely, the two standards that include an HSGPA option (Alternative 2 and Alternative 3) have higher sensitivity rates than specificity rates. Thus, these two standards can do a good job of identifying students who are ready to make postsecondary progress but will misclassify a higher percentage of students who are not ready to make postsecondary progress.

G. Discussion of Findings

In this section, we summarize the findings, highlight key limitations and caveats important for interpreting the results, and outline our plan for additional analyses that will appear in the final report.

G.1. What Are the Main Takeaways From the Preliminary Analysis?

In this interim report, we examined the properties of high school measures of college and career readiness (CCR) at the end of a student's second year of high school (HSY2) and focused on students in a Maryland public high school who enrolled in a Maryland college the fall after their expected high school graduation. The preliminary findings support the following takeaways:

- **The interim CCR standard, utilizing state assessments, correctly classified 56%–70% of students as college ready or not college ready at the end of 10th grade.** Overall, 40% of students who enrolled in a Maryland college the fall after their fourth year of high school met the interim CCR standard by the end of HSY2. The interim CCR standard correctly classified 56%–70% of students as college ready or not college ready, depending on the postsecondary progress benchmark used to validate readiness. This means that the interim CCR standard could misclassify 30%–44% of students at the end of HSY2.
  - Accuracy rates for the interim CCR standard were similar across initial postsecondary pathways, although slightly higher for students who started at a Maryland 2-year college.
  - Accuracy rates for the interim CCR standard were similar across student groups.
- **Adding an alternative way to meet the CCR standard with HSGPA increased the percentage of students who meet the CCR standard and improved accuracy rates.** Including a way to meet the standard with the interim CCR standard criteria or a high school grade point average (HSGPA) of at least 3.0 at the end of HSY2 increases the percentage of students who met the CCR standard from 40% to 64%. In addition, an alternative CCR standard with HSGPA correctly classified 67%–75% of students as college ready or not college ready, depending on the postsecondary progress benchmark used to validate readiness. This means fewer students will be misclassified at the end of HSY2 if CCR determination is based on student performance on state assessments or a student's HSGPA, rather than state assessments only. Including an option to meet the CCR standard with a PSAT score of at least 1000 did not substantively improve accuracy rates.

- Adding HSGPA into the CCR standard improved accuracy rates more for students who attended a Maryland public 4-year college (69%–81% with HSGPA compared to 62%–68% without HSGPA) than for students who attended a Maryland public 2-year college (64%–69% compared to 51%–72%).
- Adding HSGPA into the CCR standard improved the accuracy rate for many student groups. For example, with a postsecondary progress benchmark of at least 12 college credits in the first semester, the accuracy rate for only two of the 10 student groups examined was at least 70% with the interim CCR standard. The accuracy rate for nine of the 10 student groups was at least 70% with HSGPA added to the CCR standard.

G.2. What Are the Main Limitations to the Preliminary Analysis?

When interpreting the findings presented in this report, it is important to consider the potential limitations of the data and analysis. In particular, the following limitations may affect the conclusions one can draw from the study results:

- **The results from the high school graduation classes of 2017–2021 may not apply to future student cohorts.** We included five student cohorts in our analysis to minimize concerns that our results are specific to a particular time period, but the COVID-19 pandemic created unique challenges for the more recent cohorts in our sample, and shifting economic, educational, and college admissions conditions may influence factors associated with CCR, the selection of postsecondary pathways, and/or postsecondary progress. Similarly, a CCR standard was not in place when the students in our sample were in high school. The introduction of a CCR standard, and associated accountability policies, may alter students' high school and/or postsecondary experiences in ways that shift the predictive validity of specific measures.
- **The results reflect averages for Maryland college-going students and may not directly apply to specific students or postsecondary situations.** Throughout our analysis, we present results across different student groups and college sectors to gauge the extent to which the findings differ across contexts, but there may be a great deal of unexplored variation within the broad categories we examined. We did not, for example, look at how the results differ for students who pursue different areas of study within a college sector (e.g., an engineering major versus an anthropology major at a 4-year college).
- **The analysis is restricted to students who attended college the fall after their fourth year of high school.** To examine relationships between high school measures of CCR and postsecondary progress, we had to restrict the analysis to students who attended college. This means that our results about the quality of a CCR standard pertain to the subset of students who are college bound immediately after high school. It is not clear how well the results speak to CCR for high school students who never go to college or students who delay

going to college. We plan to examine alternative measures of postsecondary progress, including workforce measures, for the final report, to examine how readiness measures perform for a broader range of students.

- **The analysis is restricted to measures available for Maryland public high school students.** First, this data limitation means that we could not examine the performance of the MCAP, which is the current state assessment that will be used to determine whether students meet the CCR standard. Student performance scores on the MCAP are not available for students who already transitioned from high school to a postsecondary pathway. As a result, our analysis of state assessment scores is primarily based on the PARCC. Given that the PARCC and MCAP tests cover very similar content and given the strong correlations we see between high school tests of the same subject, we expect results based on the PARCC to apply to the MCAP as well. However, without data to formally test this assumption, one should still consider the implications of the change in state assessments. Second, we were not able to examine factors many consider important for CCR, such as self-management and self-regulatory skills, because they are not systematically measured in the state.
- **The analysis is restricted to students with available high school measures of CCR.** To examine relationships between high school measures of CCR and postsecondary progress, we had to restrict the analysis to students with available data. This restriction is a particular concern for tests that are not universally required across the state (e.g., PSAT, SAT) and measures that are uncommon in the first 2 years of high school (e.g., advanced course success). We deliberately excluded measures with significant missing or incomplete data from our analysis (e.g., SAT, advanced course success) but did examine the PSAT. If factors associated with postsecondary progress influence whether a student takes the PSAT, results based on the PSAT may be biased. We plan to conduct a supplemental analysis for the final report to examine the extent of this concern.

G.3. What Are the Next Steps for the Predictive Validity Analysis?

For the interim report, we focused on the key student groups, initial postsecondary pathways, and measures to address the main evaluation requirements from the Maryland *Blueprint*. For the final report, we will expand on the preliminary analysis to provide a more comprehensive picture of what a CCR standard might mean for Maryland's students. In particular, we plan to conduct the following analyses for the final report:

- **Examine additional high school measures of CCR.** For the interim report, we focused on four key measures for determining readiness at the end of a student's HSY2. For the final report, we will examine additional measures that are more salient for determining readiness at the end of a student's HSY4, such as SAT scores, advanced course success, and CTE course success.

- **Examine additional postsecondary pathways.** For the interim report, we focused on students who had an initial postsecondary pathway in a Maryland college. For the final report, we will include an analysis of students who had other pathways, including students who attended a non-Maryland 4-year college, students who attended no college, and students with delayed college enrollment for a year or two after high school graduation. To incorporate these additional pathways into the analysis, we will examine other measures of postsecondary progress that were not part of the interim report. For example, we will look at college-going retention and persistence for students in a non-Maryland 4-year college pathway and employment for students in a no-college pathway.
- **Examine how performance of high school measures of CCR and the interim CCR standard differs across contexts.** For the final report, we will further examine the consistency of the relationships between high school measures and postsecondary progress by estimating multivariate models that control for student characteristics and multilevel models that test the extent to which the relationships differ across schools and local education agencies.
- **Use machine learning methods to explore ways to incorporate multiple measures in a CCR standard.** For the final report, we will use classification and regression tree analysis to further explore ways to combine multiple readiness measures into a single CCR standard. This analysis will further inform the criteria one could use to construct and evaluate alternative indicators of readiness.

Alongside these additional analyses, we will continue to revise our approach to the predictive validity analysis based on what we are learning from this study's standards and content alignment analysis as well as ongoing discussions with MSDE and other key stakeholder groups. For the final report due in September 2023, we may adjust the alternative standards we test based on the findings emerging from the study's ongoing analyses.

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Maryland College and Career Readiness Empirical Study

Interim Report Technical Appendix

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Contents

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Introduction

This technical appendix is a companion to the *Maryland College and Career Readiness Empirical Study: Interim Report on the Predictive Validity Analysis*. In this appendix, we provide additional details about the study, as well as supporting results from the analysis.

A. Expanded Literature Review

This section provides a more detailed review of the relevant literature on college and career readiness (CCR) measures and their associations with students' postsecondary outcomes.

A.1. Measures of College Readiness

College Admissions and Placement Test Scores

Much of the research related to measuring college readiness focuses on norm-referenced standardized tests typically used for college admissions decisions, specifically the SAT and the ACT, and standardized tests typically used for college-level course placement decisions, specifically COMPASS and ACCUPLACER. For example, a study by the College Board (Marini et al., 2019) found positive correlations between the SAT and first-year college GPA (FYGPA) that were about the same magnitude as correlations between high school GPA (HSGPA) and FYGPA. The study also found, however, that the relationship between SAT and FYGPA was weaker at less selective colleges. Other studies conducted by the College Board provide similar evidence of the SAT's relationship with college performance (Beard & Marini, 2015, 2018; Mattern & Patterson, 2014; Westrick et al., 2020). Similarly, some studies of ACT scores find that they are positively related with FYGPA (Westrick et al., 2015).

Other studies, however, report contrasting findings that call into question the predictive validity of standardized test scores relative to other potential CCR measures, particularly HSGPA (Allensworth & Clark, 2020; Rothstein, 2004). Some of these inconsistent results are likely related to variability in the postsecondary outcomes used to validate the CCR measures. Studies of the SAT and ACT generally focus on first-year college performance (e.g., Marini et al., 2019), whereas other research (e.g., Allensworth & Clark, 2020) considers longer term definitions of college success (e.g., college graduation). In addition, some studies raise equity concerns about the reliance on college admissions tests to determine CCR. For example, Klasik and Strayhorn (2018) found that a college readiness benchmark based on the SAT could differ substantially across student groups and college selectivity. Citing equity, access, and relevance concerns,

colleges across the country have moved toward test-optional admissions policies, with one in four institutions no longer requiring submission of SAT or ACT scores in student applications (Einhorn, 2022; Herder, 2022; Tugend, 2019).

Studies of placement tests such as COMPASS and ACCUPLACER have raised concerns about these tests' predictive validity. In a study that used student-level data from a statewide community college system, Belfield and Crosta (2012) found that math and literacy test scores from COMPASS and ACCUPLACER placement examinations had positive but weak associations with college outcomes such as grades in developmental education courses, college GPA, and college credits earned. Similarly, Scott-Clayton (2012) found weak associations between scores from the same placement tests and college course grades among a large urban sample of community college students. In addition, a study of multiple placement tests (i.e., COMPASS, ACT, Michigan Merit Exam) used by two Michigan community colleges found relatively weak associations between the placement tests and students' first college-level math or English course grade (Bahr, 2016). In contrast, Leeds and Mokher (2020) studied the placement test used in Florida (Postsecondary Education Readiness Test) and found that adjusting placement cutoff scores may improve placement accuracy into the appropriate lower or upper level developmental education courses or college-level courses rather than using high school measures such as HSGPA.

State-Specific Standardized Assessment Scores

With the adoption of the Every Student Succeeds Act, states have placed more emphasis on CCR in their K–12 content standards. To reflect changes in state content standards, states revised their existing content-aligned assessments for English language arts, math, and science, in some cases adopting the assessment for one of two national consortia of states: the Smarter Balanced Assessment Consortium or the Partnership for Assessment of Readiness for College and Careers (PARCC; James, 2022). In a 2009 review of college admissions testing, Atkinson and Geiser argued that performance on curriculum-based achievement tests is a more valid indicator of college readiness than SAT/ACT scores.

There is growing evidence that scores on state content assessments administered to high school students are positively associated with college performance at about the same degree as college admissions tests such as the SAT. For example, studies conducted with data from students in Arizona (Cimetta et al., 2010), Connecticut (Coelen & Berger, 2006), and Washington (McGhee, 2003) found positive associations between the respective state assessments and college GPA. Coelen and Berger (2006) warned, however, that the quality of the relationship differs across institution type and subject area. More recently, a study of college students in New York and Kentucky found that state high school tests predicted FYGPA about as well as college admissions tests scores (Koretz et al., 2016). Similarly, a study

conducted in Massachusetts examined the state's assessment and the PARCC and concluded that both tests predicted FYGPA about as well as the SAT (Nichols-Barrer et al., 2015). A study conducted in Iowa also found that readiness benchmarks on the Iowa Assessments and the ACT were similarly predictive of FYGPA in required general education courses (Fina et al., 2018).

High School GPA

Several studies on college readiness examined how well HSGPA predicts college performance, particularly in contrast or in addition to test-based measures. Although standardized test scores primarily focus on content knowledge and cognitive strategies (e.g., problem solving, reasoning) in two or three subject areas, HSGPA can reflect a student's content knowledge, cognitive strategies, and academic behaviors (e.g., self-regulation, study skills) across many subject areas and for a longer period of time (Borghans et al., 2016; Brookhart et al., 2016; Galla et al., 2019; Kautz et al., 2017). However, some researchers have raised concerns about using HSGPA as a measure of college readiness because of the subjective nature of grading (Brackett et al., 2013; Kunnath, 2017; Lipnevich et al., 2020) and evidence of grade inflation (Camara et al., 2004; Sanchez & Moore, 2022).

Despite concerns about inconsistencies in HSGPA, several studies indicate that HSGPA is a strong and reliable predictor of various college outcomes. For example, Allensworth and Clark (2020) examined the relationship of cumulative HSGPA with college graduation rates for students in Chicago public schools. They found HSGPA was a stronger predictor of degree completion across all institution types (e.g., 4-year universities, community colleges) than ACT scores, downplaying grade inflation and GPA subjectivity concerns raised in other research. Furthermore, Belfield and Crosta (2012) studied cumulative HSGPA and found that it had positive associations with overall college GPA and cumulative college credits earned, explaining approximately 21% of the variation in overall college GPA and 14% of the variation in college credit accumulation. Similarly, Galla et al. (2019) found that HSGPA was a stronger predictor of college graduation than SAT/ACT scores. In addition, a study focused on Arkansas students (Hester et al., 2021) found that an HSGPA of at least 2.8 was a significant predictor of both initial college enrollment and sustained enrollment for more than one term (i.e., persistence).

High School Course-Taking

High school course-taking is another domain that researchers and policymakers consider as a potential measure of college readiness. For example, the Hester et al. (2021) study in Arkansas found that taking at least one advanced course in high school—defined as Advanced Placement (AP), International Baccalaureate (IB), or advanced career education—was the strongest predictor of college enrollment and success from the high school measures they examined. Similarly, Belfield and Crosta (2012) used high school transcript data and found that both college GPA and college credits were strongly correlated with high school course-taking CCR

measures, such as the number of honors courses attempted, the number of college-level credits earned in high school, and whether the student ever received a failing grade.

Adelman (1999, 2006) created a composite measure of curricular intensity, which is defined by the accumulated number of core course credits (quantity) and the rigor of coursework completed in each subject (quality). Using nationally representative longitudinal survey data, Adelman found a strong relationship between curricular intensity and both postsecondary persistence and the attainment of a bachelor's degree. Indicators of quantity were based on the number of course credits completed, particularly in math, English, science, foreign language, social science, and computer science. The indicators of quality were the highest math course completed, the number of credits completed in core science courses, whether the student took at least one AP course, and whether the student took remedial math or English (Adelman, 1999). Austin (2020) proposed a shorter version of Adelman's curricular intensity index and compared the predictive validity of the proposed curricular intensity measure—a single indicator (highest math course taken) or a combination of the math indicator plus AP coursework—to that of the original curricular intensity model on several college outcomes. The new measure had predictive validity that was comparable to or better than the original, and the new model explained as much or more variance in college outcomes. However, the use of advanced course taking and dual enrollment in a CCR standard may raise equity concerns given disparate access to such opportunities (Xu et al., 2019).

Multiple Measures for College Readiness

Although much of the research on college readiness focuses on the performance of specific measures, studies also highlight the strengths of using a combination of measures to predict college readiness. For example, a 2020 report by the Education Strategy Group reviewed the research and recommended the use of three high school measures to monitor whether students are prepared for college: ninth-grade GPA, completion of advanced coursework (i.e., AP, IB, dual enrollment), and participation in career and technical education (CTE) coursework.

Relatedly, research on college course placement decisions points to the benefits of using multiple measures. Two parallel experimental studies found that using multiple measures for placement in community college developmental courses resulted in better student outcomes than using a single measure (Cullinan & Kopko, 2022). One study included seven community colleges in New York that tested an algorithmic placement system that incorporated placement test scores, HSGPA, and information about high school graduation (Bergman et al., 2023). The other study included five community colleges in Minnesota and Wisconsin that tested a placement system that incorporated placement test scores, HSGPA, noncognitive assessment results, and scores from the ACT or SAT (Cullinan & Biedzio, 2021). Both studies found that using a placement algorithm that incorporates multiple measures instead of a single placement

examination to determine who should take developmental courses increased college credits earned and reduced costs for students. In addition, the use of multiple measures may result in more equitable placement decisions, especially if HSGPA and self-directed placement mechanisms are included in the decision process (Kopko et al., 2022).

A.2. Measures of Career Readiness

As noted earlier, career readiness metrics are less standardized and less often viewed as stand-alone metrics compared with college readiness metrics. As a result, research on how well measures of career readiness predict career outcomes is much more limited than research on measures of college readiness. Still, one relatively common measure associated with career readiness that has been examined in prior research is student participation in CTE. There is growing evidence that completing a CTE curriculum gives students a leg up in the workforce. For example, using data on all Massachusetts high school students expected to graduate high school from spring 2009 to 2017, Ecton & Dougherty (2023) found that in each of the first 7 years after high school, students who attended a dedicated CTE school experienced significantly higher and increasing annual earnings than students who completed a CTE pathway within a traditional, "comprehensive" high school. In addition, they found that CTE completers (regardless of school type) had higher earnings than noncompleters in the first year after high school (about $1,400) and a higher likelihood of employment the year after high school (about 4 percentage points higher) when compared with similar CTE participants who did not complete the program or go to college.

For students who do not attend college, the effect of CTE on employment rates is much higher (about 14 percentage points). Lindsay et al. (2021) compared CTE "concentrators" with students who took two or fewer CTE courses in Indiana and Minnesota. They found that in the year after high school, concentrators were 2 percentage points to 4 percentage points more likely to be employed and earned $1,100–$1,300 more. Completing a concentrated CTE curriculum improved labor outcomes, but Ecton and Dougherty (2023) showed that the effects of CTE can vary based on the type of CTE concentration. For example, the increase in annual earnings in the year after high school was highest when students concentrated in construction ($3,100), health care ($3,000), or transportation ($3,000) and lowest when students concentrated in arts and communication ($1,000). In all cases, the effect was strongest for those who did not attend college. Although recent evidence suggests that CTE participation can lead to improved content knowledge and academic behavioral development in high school and the potential for higher earnings in the workforce, evidence regarding the types of programs that deliver the most important CCR outcomes, including CTE's impact on college readiness, is still emerging (Dougherty, 2023).

B. Additional Information About the Predictive Validity Analysis

This section provides additional information about the analytic approaches that the American Institutes for Research (AIR) employed to conduct the predictive validity analysis. In addition, we present technical data details and analytic decisions made as we carried out the analyses.

B.1. Initial Postsecondary Pathways

Initial postsecondary pathways were defined based on enrollment in a postsecondary institution in the fall term immediately following expected on-time high school graduation. The interim report focuses on the initial postsecondary pathways for students who enrolled in a Maryland college. Exhibit T.1 lists the colleges and universities included in each Maryland postsecondary pathway, inclusive of public 2-year institutions (*n* = 16); public 4-year institutions (*n* = 13); and private, nonprofit, 4-year institutions (*n* = 13).

In cases when a student had duplicate enrollment records for the same academic year and term (either within a postsecondary institution or across multiple institutions), a single primary enrollment record was retained based on the following priority considerations:

- Institution at which the student attempted the greatest number of credits applicable toward a degree (i.e., largest value rather than smaller and missing values)
- Maryland postsecondary institution rather than out-of-state institution
- 4-year institution rather than 2-year institution
- Most recently reported data

For students attending a college affiliated with the Maryland Higher Education Commission, academic statuses were screened to exclude non-degree-seeking enrollment records (e.g., summer enrollment at a community college as a non-degree-seeking student) and enrollment when the recorded credential sought is above the bachelor's degree (e.g., master's or postbaccalaureate certificate). Enrollment records for dual-enrolled high school students (i.e., postsecondary enrollment before high school completion) also were excluded.

Exhibit T.1. Maryland Postsecondary Institutions Included in Each Initial Postsecondary Pathway

Postsecondary Sector	Postsecondary institutions
Maryland public: 2-year	Allegany College of Maryland
	Anne Arundel Community College
	Baltimore City Community College
	Carroll Community College
	Cecil College
	Chesapeake College
	College of Southern Maryland
	Community College of Baltimore County
	Frederick Community College
	Garrett College
	Hagerstown Community College
	Harford Community College
	Howard Community College
	Montgomery College
	Prince George's Community College
	Wor-Wic Community College
Maryland public: 4-year	Bowie State University
	Coppin State University
	Frostburg State University
	Morgan State University
	Salisbury University
	St. Mary's College of Maryland
	Towson University
	University of Baltimore
	University of Maryland–Baltimore
	University of Maryland–Baltimore County
	University of Maryland–College Park
	University of Maryland–Eastern Shore
	University of Maryland–Global Campus

Postsecondary Sector	Postsecondary institutions
Maryland private: 4-year	Capitol Technology University[a]
	Goucher College
	Hood College
	Johns Hopkins University
	Loyola University Maryland
	Maryland Institute College of Art
	McDaniel College
	Mount St. Mary's University
	Notre Dame of Maryland University
	St. John's College
	Stevenson University
	Washington Adventist University
	Washington College

[a] The data file lists this institution under its former name, Capitol College.

Exhibit T.2a. Prevalence of Initial Postsecondary Pathways for the HSY2 Student Sample, by Student Cohort

Student cohort	Number in HSY2 sample	MD Public: 2-year	MD public: 4-year	MD private: 4-year	Non-MD college: 4-year	No college
Total student sample	318,967	19%	16%	3%	15%	46%
Class of 2017	61,514	21%	16%	2%	16%	43%
Class of 2018	63,775	20%	16%	3%	16%	44%
Class of 2019	63,020	20%	16%	3%	16%	45%
Class of 2020	65,853	19%	15%	3%	14%	49%
Class of 2021	64,805	16%	17%	2%	15%	49%

Note. HSY = high school year; MD = Maryland.

Exhibit T.2b. Prevalence of Initial Postsecondary Pathways for the HSY2 Student Sample, by Student Characteristics

Student group	Number in HSY2 sample	MD public: 2-year	MD public: 4-year	MD private: 4-year	Non-MD college: 4-year	No college
All students	318,967	19%	16%	3%	15%	46%
Sex/gender						
Female	156,512	20%	18%	3%	18%	39%
Male	162,441	18%	14%	2%	12%	53%
Race/ethnicity[a]						
Asian	21,085	22%	39%	3%	17%	18%
Black/African American	107,715	17%	16%	2%	12%	52%
Hispanic/Latinx	50,316	19%	6%	2%	6%	66%
White	126,381	21%	16%	3%	22%	38%
Multiracial	12,299	19%	16%	3%	18%	43%
English learners, current[b]	20,564	11%	2%	1%	1%	85%
English learners, recent exit[b]	13,718	26%	19%	3%	8%	43%
Students with disabilities	32,903	16%	3%	1%	4%	76%
FARMS eligible	120,395	18%	10%	2%	6%	65%

Note. Student characteristics were defined based on a student's status as of the end of their second year of high school. The table does not include students who attended a 2-year non-Maryland college because less than 1% of students had this as their initial postsecondary pathway. FARMS = free and reduced-price meals services; HSY = high school year; MD = Maryland.

[a] Less than 1% of students were classified as American Indian, Alaska Native, Native Hawaiian, or Pacific Islander.

[b] For the purposes of our analysis, students were considered a current English learner if they were classified as an English learner at the end of their second year of high school. Students were considered a recent exit if they were reclassified within 2 years prior to the end of their second year of high school.

Exhibit T.2c. Prevalence of Initial Postsecondary Pathways for the HSY2 Student Sample, by Maryland Local Education Agency

Local education agency	Number in HSY2 Sample	MD Public: 2-year	MD Public: 4-year	MD Private: 4-year	Non-MD College: 4-year	No College
All local education agencies	318,967	19%	16%	3%	15%	46%
Allegany County	3,060	23%	15%	1%	8%	52%
Anne Arundel County	28,559	23%	13%	2%	15%	45%
Baltimore City	25,057	13%	13%	3%	6%	65%
Baltimore County	39,482	20%	17%	4%	12%	47%
Calvert County	6,433	24%	14%	2%	18%	41%
Caroline County	1,990	17%	11%	2%	8%	60%
Carroll County	10,225	22%	15%	5%	20%	37%
Cecil County	5,702	22%	8%	2%	12%	54%
Charles County	10,535	22%	14%	2%	17%	45%
Dorchester County	1,580	14%	12%	3%	6%	64%
Frederick County	15,751	23%	15%	4%	20%	37%
Garrett County	1,418	23%	8%	–	12%	55%
Harford County	14,000	24%	13%	3%	16%	43%
Howard County	21,091	22%	28%	3%	22%	24%
Kent County	708	13%	9%	–	15%	58%
Montgomery County	59,845	18%	20%	2%	23%	36%
Prince George's County	45,499	15%	14%	1%	9%	59%
Queen Anne's County	2,890	22%	14%	3%	20%	40%
Somerset County	6,307	22%	10%	1%	14%	52%
St. Mary's County	935	21%	10%	1%	5%	62%
Talbot County	1,768	19%	13%	4%	15%	48%
Washington County	8,476	23%	7%	2%	13%	53%
Wicomico County	5,162	17%	17%	2%	9%	54%
Worcester County	2,494	16%	20%	2%	14%	47%

Note. The exhibit does not include students who attended a 2-year non-Maryland college because less than 1% of students had this as their initial postsecondary pathway. – = cell value was suppressed due to small sample size.

B.2 High School Measures of College and Career Readiness

Our analysis of potential high school measures of CCR was limited to measures available in the MLDS data for the years that students in our study sample were in high school. We considered many measures for the predictive validity analysis (see Exhibit T.3). However, many of the measures were not available for most of the students in our study sample (see Exhibit T.4).

Data used for the calculation of GPA come from the annual enrollment files from the Maryland State Department of Education (MSDE). For school years 2012–13 through 2015–16, these enrollment files provide information on the letter grade earned and the number of units attempted in each course. For school years 2016–17 through 2020–21, we used letter grades from the enrollment files and the course lookup table to determine units attempted because enrollment files in these years do not have information on units attempted. We calculated cumulative GPA at the end of Year 2 as the sum of all grade points earned in the first 2 years of high school attendance divided by the total number of credits attempted for a grade in the first 2 years of high school attendance. A similar calculation was made for cumulative GPA at the end of Year 4. The grade points for a specific course are equal to the product of the number of credits in the course (typically 1 or 0.5) and the grade points associated with each letter grade (see Exhibit T.5). Courses taken as credit/no credit or were listed as 0 credits were not included in the calculation of GPA. In some cases, IB courses between 2017 and 2021 provided the student's score on the IB examination in place of a letter grade. In these cases, IB examination scores were converted to grade points according to the crosswalk provided by Gia Su (2021).

In cases where students did not have reported GPAs for one or more academic years, we determined cumulative GPA at 2 years and 4 years based on a few rules. If a student was missing GPA for Year 1 but not Year 2, then cumulative GPA at the end of Year 2 was equal to the GPA from Year 2. If a student was missing GPA for Year 2, but not Year 1, then cumulative GPA at the end of Year 2 was equal to the GPA from Year 1. Cumulative GPA at the end of Year 4 was calculated as the cumulative GPA from all courses taken in the four years since the student first attended a Maryland public high school, even if the student did not attempt courses in one or more of those years.

In addition to calculating overall GPA, we calculated two other versions of GPA: GPA in core courses and GPA in primary core courses. Core courses are those flagged as "core academic subjects" as outlined in the 2015 SCGT Manual (MSDE, 2015). These include courses such as language, art, dance, science, math, and social studies but exclude courses such as agriculture, marketing, journalism, physical education, and psychology (see Exhibit T.6). Cumulative GPAs using only these core courses are highly correlated with overall cumulative GPAs ($r = 0.98$). Finally, we calculated cumulative GPAs in "primary core courses" by limiting the calculation to

courses in only math, science, English, and social studies. Cumulative GPAs using only these primary core courses also are highly correlated with overall cumulative GPAs (r = 0.95).

Exhibit T.3. High School Measures of College and Career Readiness Considered for the Predictive Validity Analysis

Type of measure	Measure	Description
Test score[a]	English 10 state assessment score	Scale score on the HSA Reading or PARCC English 10 assessment. We converted the HSA scores to PARCC-equivalent scores using the concordance table developed by MARC.
Test score[a]	Algebra 1 state assessment score	Scale score on the HSA Algebra or PARCC Algebra 1 assessment. We converted the HSA scores to PARCC-equivalent scores using the concordance table developed by MARC.
Test score[a]	Algebra 2 state assessment score	Scale score on the PARCC Algebra 2 assessment.
Test score[a]	Geometry state assessment score	Scale score on the PARCC Geometry assessment.
Test score[a]	SAT math score	SAT math score.
Test score	SAT reading score	SAT "evidence-based reading and writing" score. Prior to 2016, the SAT included separate verbal and writing scores. For the earlier version of the SAT, we created one reading score by taking the average of the verbal and writing scores.
Test score	SAT composite score	Sum of a student's highest SAT math and SAT reading scores.
Test score	PSAT math score	PSAT math score on the NMSQT version. Prior to 2016, the PSAT was on a different scale and was not comparable to the current version. We converted the earlier PSAT scores to the current PSAT scale using concordance tables developed by the College Board (2016).
Test score	PSAT reading score	PSAT reading score on the NMSQT version. Prior to 2016, the PSAT was on a different scale and was not comparable to the current version. In addition, the earlier version included separate reading and writing scores. We converted the earlier PSAT scores (total reading and writing score) to the current PSAT scale using concordance tables developed by the College Board (2016).
Test score	PSAT composite score	Sum of a student's highest PSAT math and PSAT reading scores.

Type of measure	Measure	Description
Test score	ACT math score	ACT math score.
Test score	ACT reading score	Average of the ACT reading and ACT English scores.
Test score	ACT composite score	Average of the ACT math, ACT reading, ACT English, and ACT science scores.
HSGPA	Overall GPA	We calculated a student's GPA by taking the sum of all grade points earned in every course a student took for a grade in the first 2 (or 4) years of high school and divided by the sum of all units attempted for a grade in the same time period.
HSGPA	Academic subjects GPA	The sum of all grade points earned in every course identified as "academic" by MSDE (2015) taken for a grade in the first 2 (or 4) years of high school, divided by the sum of all units attempted for a grade in every course identified as "academic" by MSDE in the first 2 (or 4) years of high school.[b]
HSGPA	Core academic subjects GPA	The sum of all grade points earned in every core academic course (English, math, science, and social studies) taken for a grade in the first 2 (or 4) years of high school divided by the sum of all units attempted for a grade in every core academic course (English, math, science, and social studies) in the first 2 (or 4) years of high school.
Advanced course success	Passed college-level course	Received a passing grade (D or higher, "credit," or "passing") in an AP or IB course or earned credit in a dual-enrollment course.
Advanced course success	Passed a CTE course	Received a passing grade (D or higher "credit," or "passing") in a CTE course.

Note. AP = Advanced Placement; CTE = career and technical education; HSA = Maryland High School Assessment; HSGPA = high school grade point average; IB = International Baccalaureate; MARC = Maryland Assessment Research Center; MSDE = Maryland State Department of Education; NMSQT = National Merit Scholarship Qualifying Test; PARCC = Partnership for Assessment of Readiness for College and Careers.

[a] Measure is part of the interim college and career readiness standard. [b] See Exhibit TA.4 for a list of subjects included in this measure.

Exhibit T.4. Percentage of Students With Test Scores, by Student Cohort

Measure and timing	2017 cohort	2018 cohort	2019 cohort	2020 cohort	2021 cohort
Number of students	61,514	63,775	63,020	65,853	64,805
PARCC, English 10					
By end of HSY2	86%	91%	90%	89%	91%
By end of HSY4	92%	95%	95%	94%	91%
PARCC, Algebra 1					
By end of HSY2	91%	89%	91%	91%	92%
By end of HSY4	93%	91%	93%	93%	92%
PARCC, Algebra 2					
By end of HSY2	25%	23%	21%	16%	8%
By end of HSY4	44%	42%	37%	17%	8%
PARCC, Geometry					
By end of HSY2	0%	1%	4%	10%	13%
By end of HSY4	3%	4%	5%	10%	13%
PSAT, composite					
By end of HSY2	79%	77%	71%	67%	68%
By end of HSY4	85%	83%	79%	79%	80%
SAT, composite					
By end of HSY2	2%	2%	2%	2%	2%
By end of HSY4	60%	61%	66%	72%	25%
ACT, composite					
By end of HSY2	0%	0%	0%	0%	0%
By end of HSY4	19%	23%	21%	13%	5%
High school GPA					
By end of HSY2	98%	98%	97%	98%	98%
By end of HSY4	98%	98%	98%	98%	99%

Note. PARCC English 10 and PARCC Algebra 1 include students who took the equivalent HSA test. If a student has a composite score, they also have the subject-specific scores included in the composite. HSA = Maryland High School Assessment; HSY = high school year; PARCC = Partnership for Assessment of Readiness for College and Careers.

Exhibit T.5. Grade Points Used for Each Letter Grade

Letter grade	Grade points
A+	4.0
A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
D+	1.3
D	1.0
D-	0.7
F	0.0

Exhibit T.6. MDSE Core Academic Subjects

Art	Dance	Drama/theatre
Kindergarten education	Elementary education	English[a]
Reading	ESOL	French
German	Latin	Russian
Spanish	Other foreign language	Multiple language course
Arabic	Chinese	Italian
Japanese	Portuguese	Turkish
Mathematics[a]	Music	Biology[a]
Chemistry[a]	Earth/space science[a]	General science[a]
Geology[a]	Physical science[a]	Physics[a]
Environmental science[a]	Economics	Geography
History	Political science	Social studies[a]

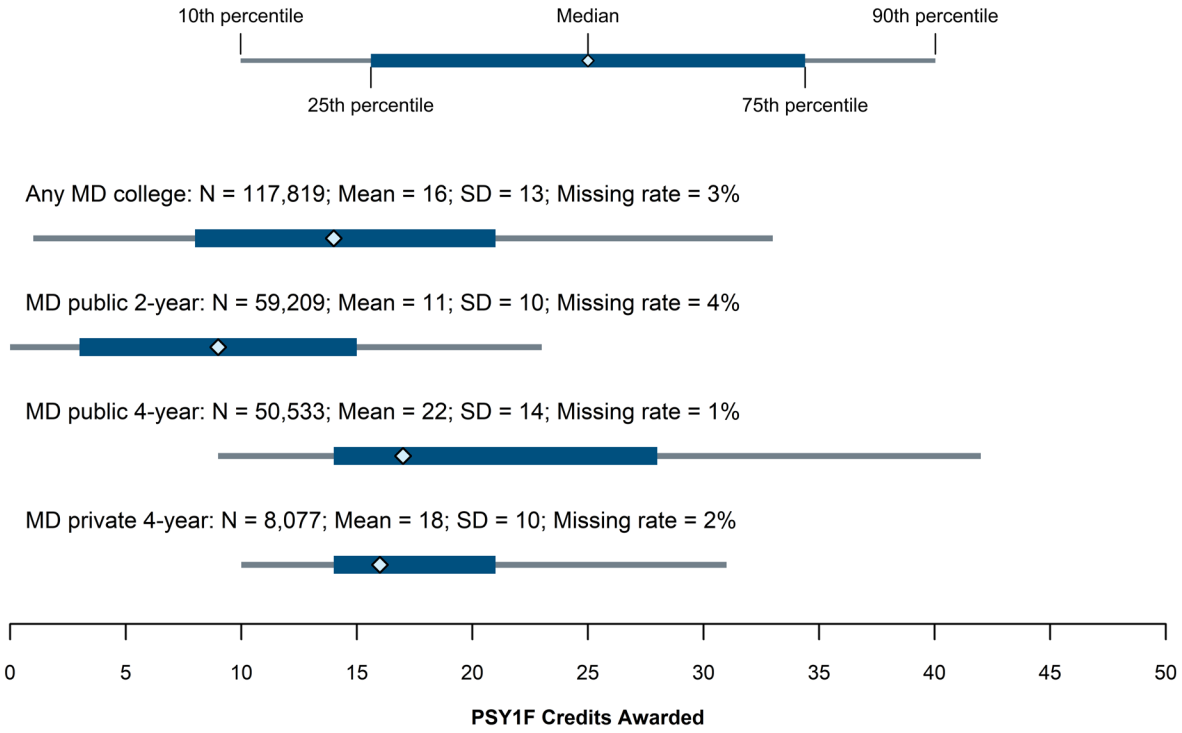
Note. ESOL = English for speakers of other languages.

[a] Denotes subjects that we include in measures for "primary core academic subjects."

B.3 Measures of Postsecondary Progress

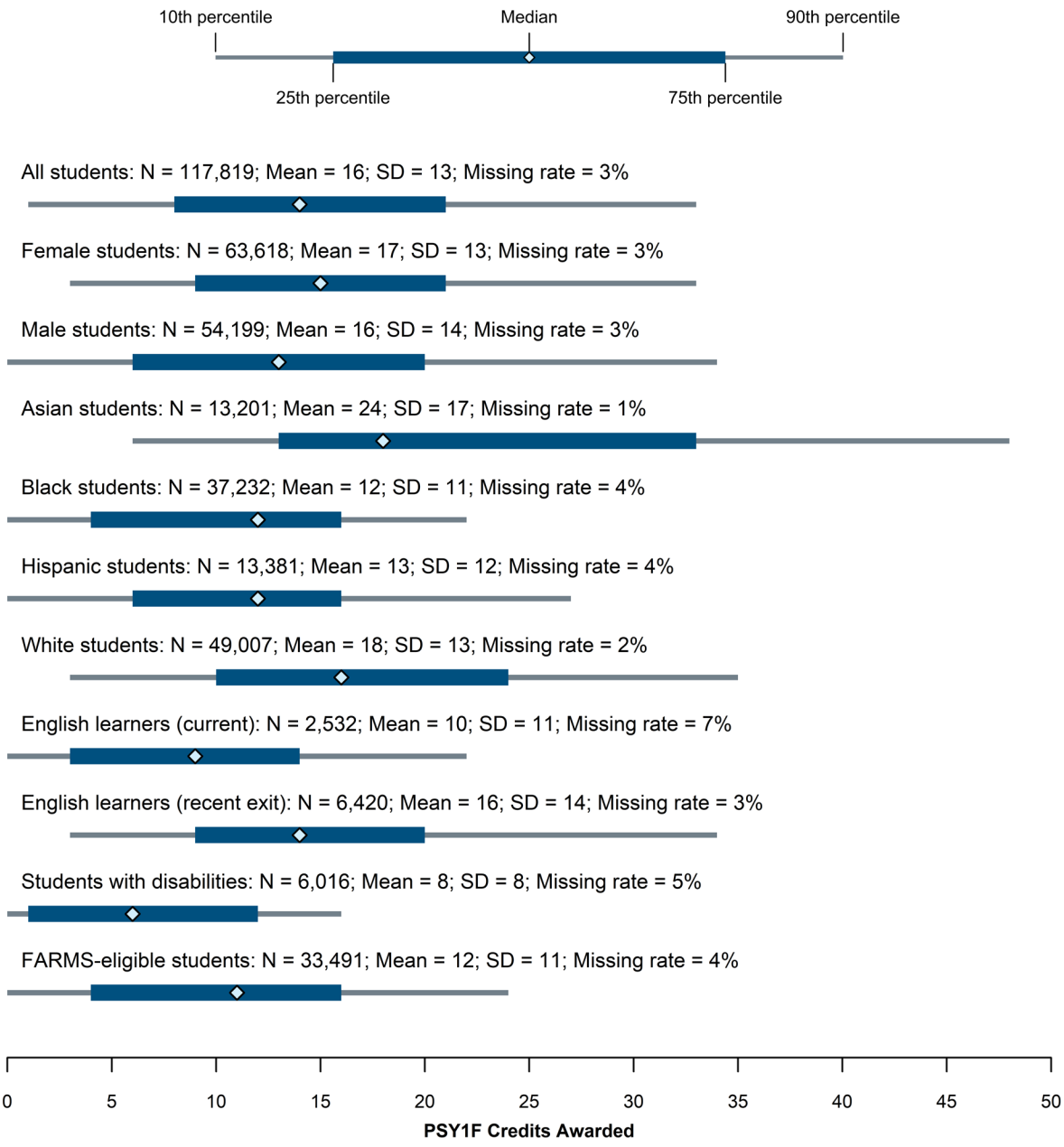
For the interim report, we examined two measures of postsecondary progress that focus on success in first-year credit-bearing college coursework: (a) the number of college course credits accumulated during the first postsecondary year and (b) the GPA during the first postsecondary year. These two measures are available in the MLDS only for Maryland colleges with course credit data. Summary statistics for the fall semester versions of the measures are in Exhibits T.7a and T.8a (by initial postsecondary pathway) and Exhibits T.7b and T.8b (by student group).

Exhibit T.7a. Distribution of College Credit Accumulation in First Year Fall Semester, by Initial Postsecondary Pathway



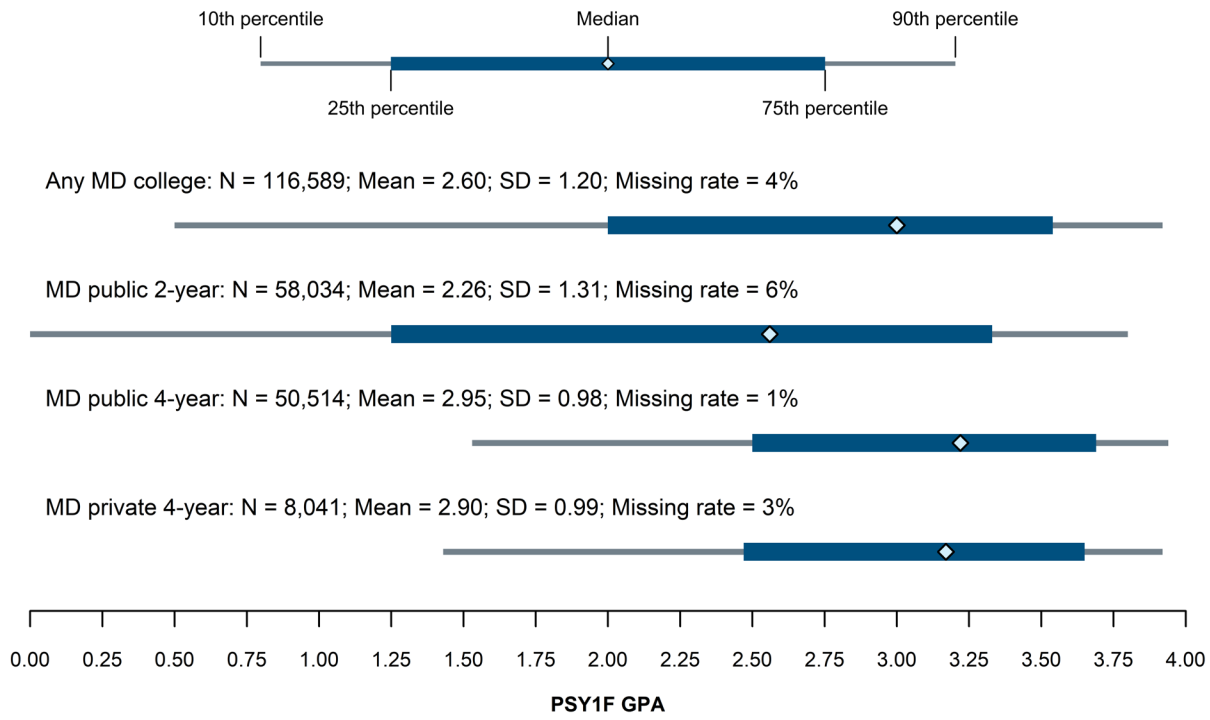
Note. MD = Maryland; PSY1F = postsecondary Year 1 fall semester.

Exhibit T.7b. Distribution of College Credit Accumulation in First Year Fall Semester, by Student Group



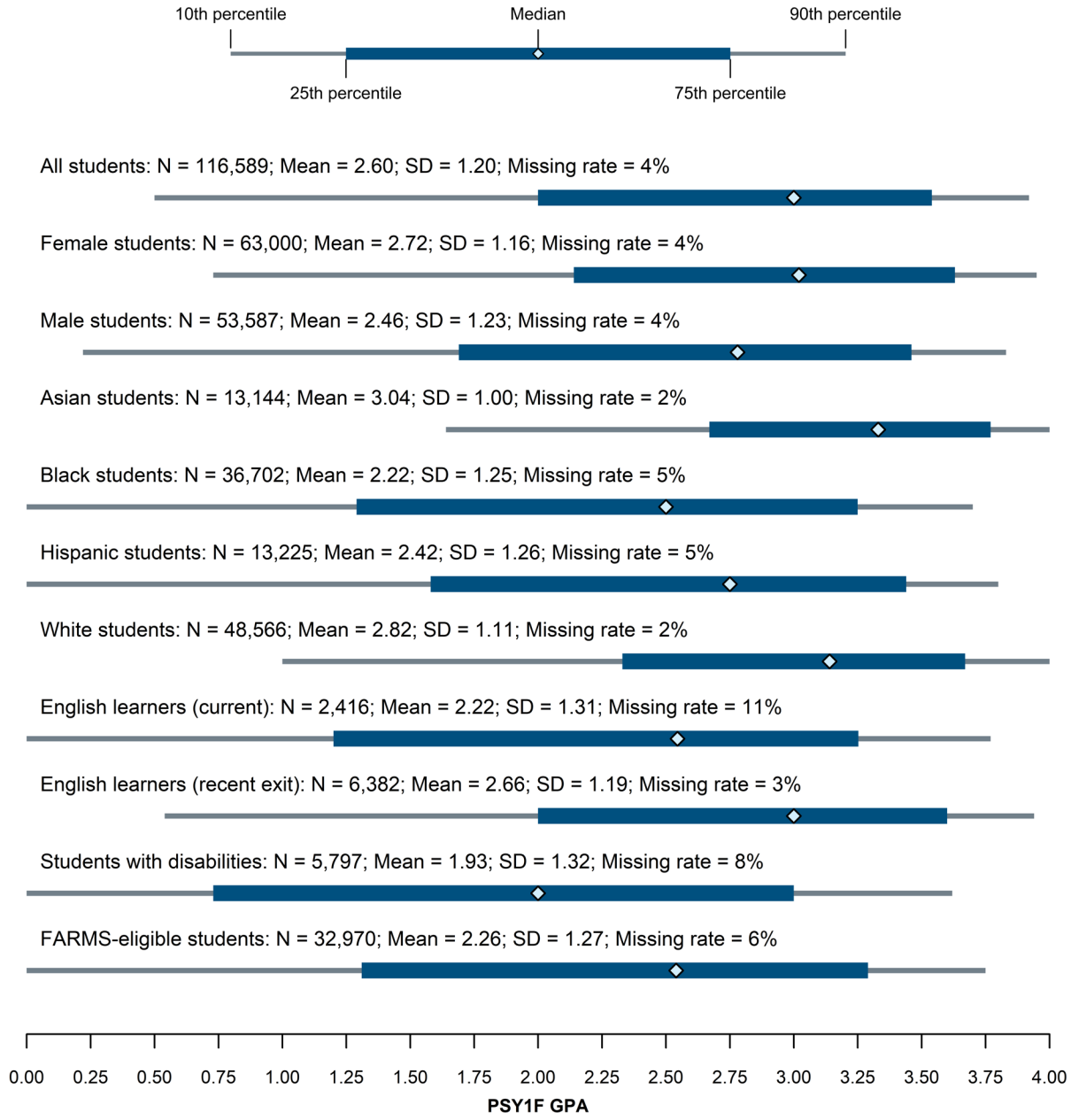
Note. FARMS = free and reduced-price meal services; PSY1F = postsecondary Year 1 fall semester.

Exhibit T.8a. Distribution of College GPA in First Year Fall Semester, by Initial Postsecondary Pathway



Note. MD = Maryland; PSY1F = postsecondary Year 1 fall semester.

Exhibit T.8b. Distribution of College GPA in First Year Fall Semester, by Student Group



Note. FARMS = free and reduced-price meal services; PSY1F = postsecondary Year 1 fall semester.

B.4. Additional Information About the Analysis for Research Question 1

Describing the Characteristics of Potential Readiness Measures

We characterized each measure's distribution using central tendency statistics (mean and median) and statistics that summarize variability (standard deviation, interquartile range, and 10th to 90th percentile range). We also considered the percentage of nonmissing data for each measure. To examine correlations between measures, we calculated pairwise Pearson product-moment correlation coefficients. These statistics help us gauge the implications of how the operationalization of a specific measure might classify students across the state.

Estimating Bivariate Relationships Between Potential Readiness Measures and Postsecondary Progress

To determine potential thresholds for identifying readiness from a single measure, we used logistic regression modeling to estimate the bivariate relationship between a high school measure (e.g., PARCC English 10 score) and meeting a dichotomous postsecondary progress benchmark (e.g., awarded at least 12 credits in the first semester). We used these model results to estimate the predicted probability of meeting a postsecondary progress benchmark at different levels of a high school measure of CCR. These estimates helped us determine the values for a given measure associated with at least a 50% probability of meeting a postsecondary progress benchmark. We estimated separate logistic models for different student groups and initial postsecondary pathways to examine whether potential high school measures operate differently for some students compared with others. For the final report, we will further examine the consistency of the relationships by estimating multivariate models that control for student characteristics and multilevel logistic models that test the extent to which the relationships between high school measures of readiness and postsecondary progress benchmarks differ across schools and local educational agencies.

Estimating the Strength of Association Between Multiple Readiness Measures and Postsecondary Progress

To examine how the simultaneous use of multiple high school measures of readiness could improve predictions of postsecondary progress, we estimated a series of linear regression models to estimate how well different combinations of readiness measures explained variation in the number of postsecondary credits awarded and postsecondary GPA during a student's first year of college (PSY1). Our particular focus was on the percentage of variance in a postsecondary progress measure explained by different combinations of high school measures (i.e., the *R*-squared statistic). We estimated separate regression models for different student groups and initial postsecondary pathways to examine whether the explanatory power of different high school measures differed for some students compared with others.

For the final report, we will use classification and regression tree analysis to further explore ways to combine multiple readiness measures into a single CCR standard. This analysis will further inform the criteria that one could use to construct and evaluate alternative indicators of readiness. This analysis will result in determining a set of thresholds for key readiness measures that optimally predict postsecondary progress.

C. Supplemental Results

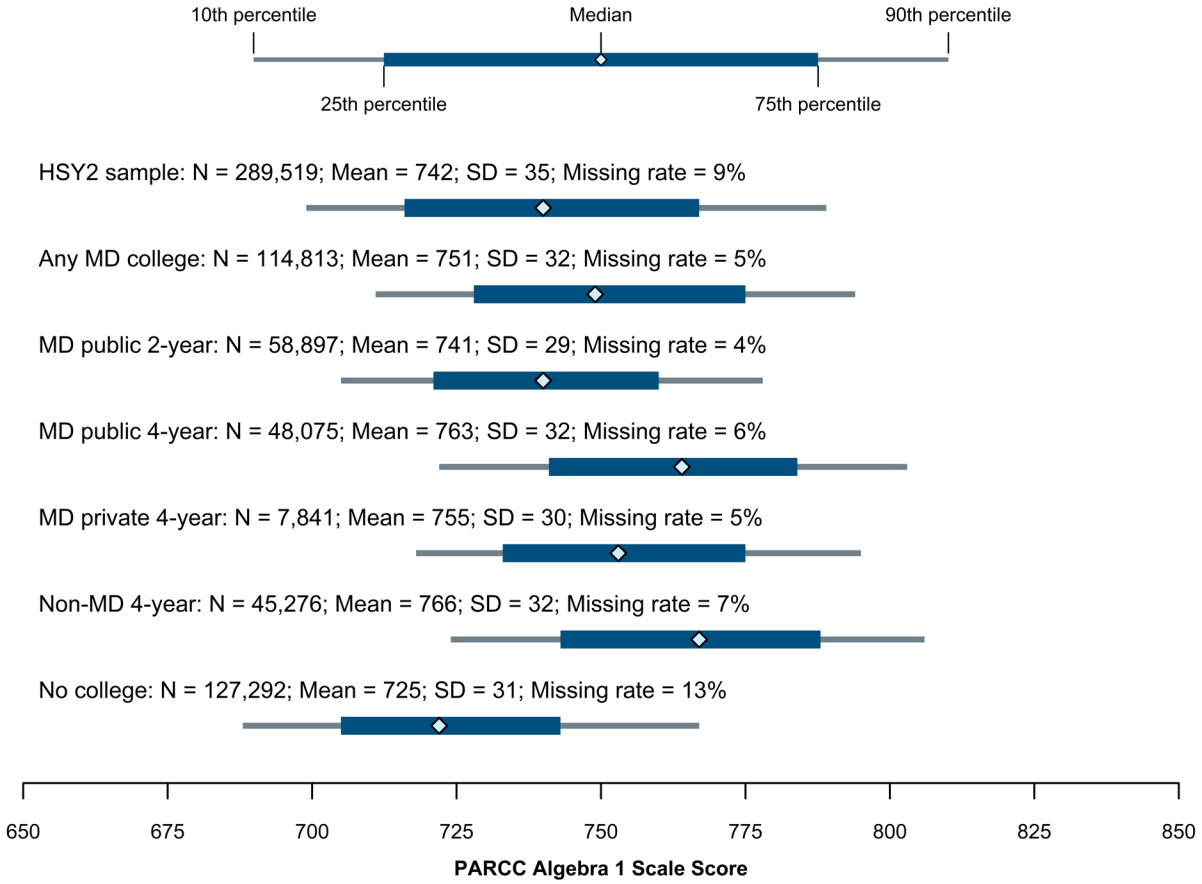
This section provides results that supplement the discussion and findings in the interim report.

C.1. Description of High School Measures of College and Career Readiness

Exhibits T.9a–T.11b present the range of scores at the HSY2 time point for the PARCC Algebra 1, PSAT composite, and overall HSGPA measures, by initial postsecondary pathway and student group, respectively. The exhibits show the 10th to 90th percentile range (gray bars) and the 25th to 75th percentile range (dark blue bars) for students' scores. The median, or 50th percentile, is represented by a light blue diamond. In addition, the exhibits report the mean scores, the standard deviation, and the percentage of students without a score.

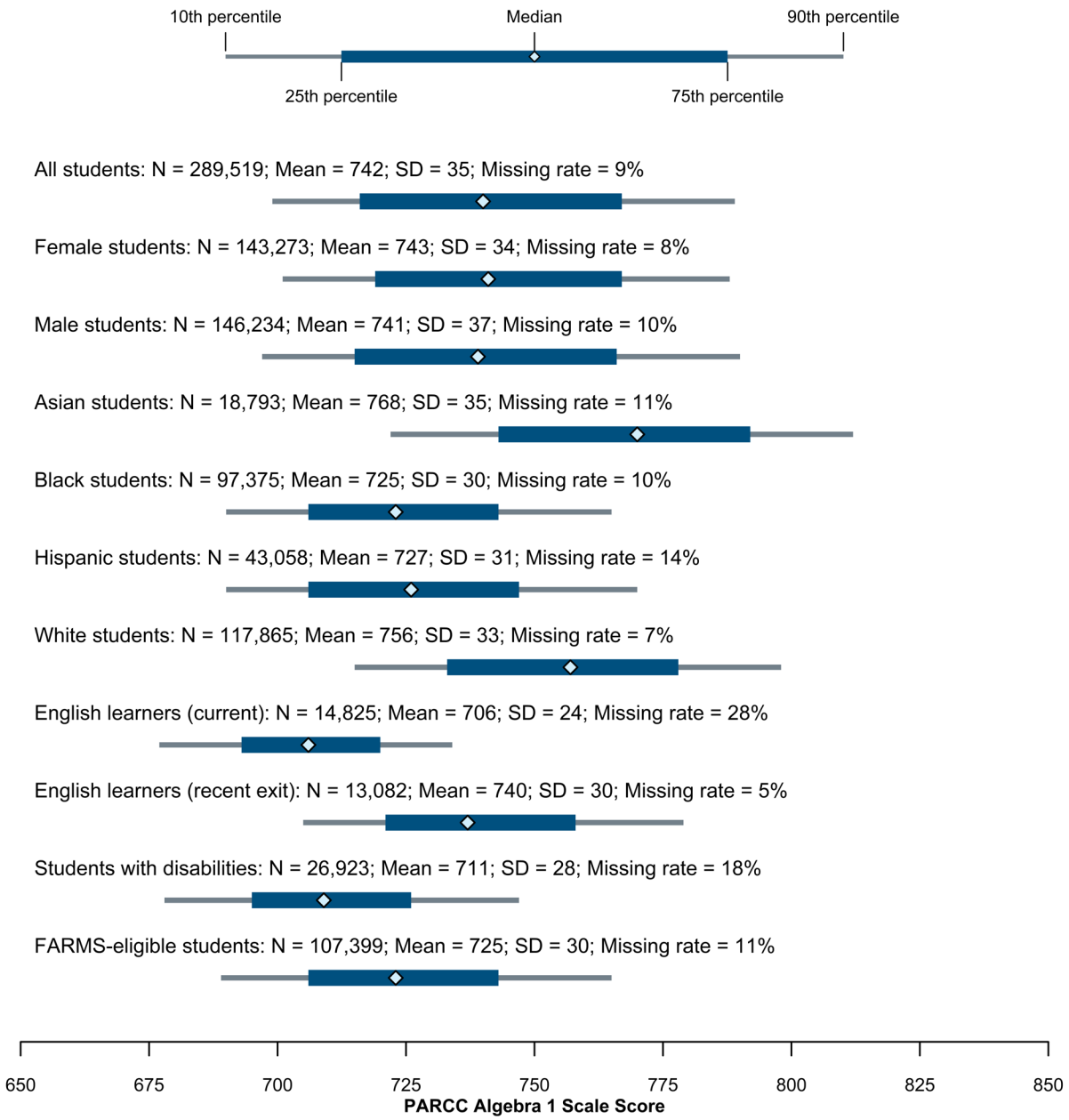
Potential high school measures of CCR should relate with each other if they reflect overlapping aspects of readiness (e.g., content knowledge) and/or share underlying factors that influence a student's readiness (e.g., instructional quality). If, however, the individual measures are very strongly associated with each other, they may not capture distinct dimensions of readiness, and multiple measures in a CCR standard may not improve the quality of the standard. In Exhibit T.12, we report the correlation coefficients for each high school measure of CCR considered for the analysis. Correlation coefficients can range from -1 to 1, with values closer to 1 indicating a stronger positive relationship.

Exhibit T.9a. Distribution of PARCC Algebra 1 Scores at End of HSY2, by Initial Postsecondary Pathway



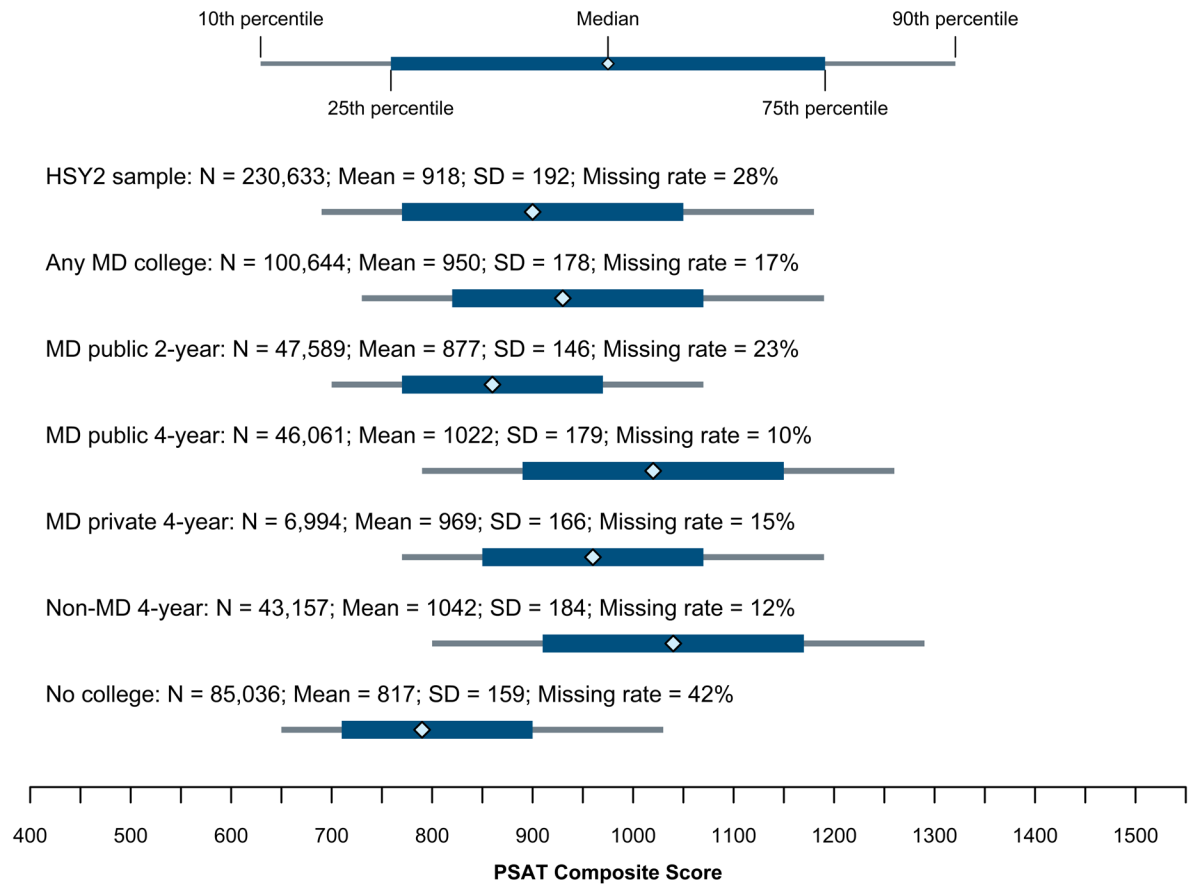
Note. HSY = high school year; MD = Maryland; PARCC = Partnership for Assessment of Readiness for College and Careers.

Exhibit T.9b. Distribution of PARCC Algebra 1 Scores at End of HSY2, by Student Characteristics



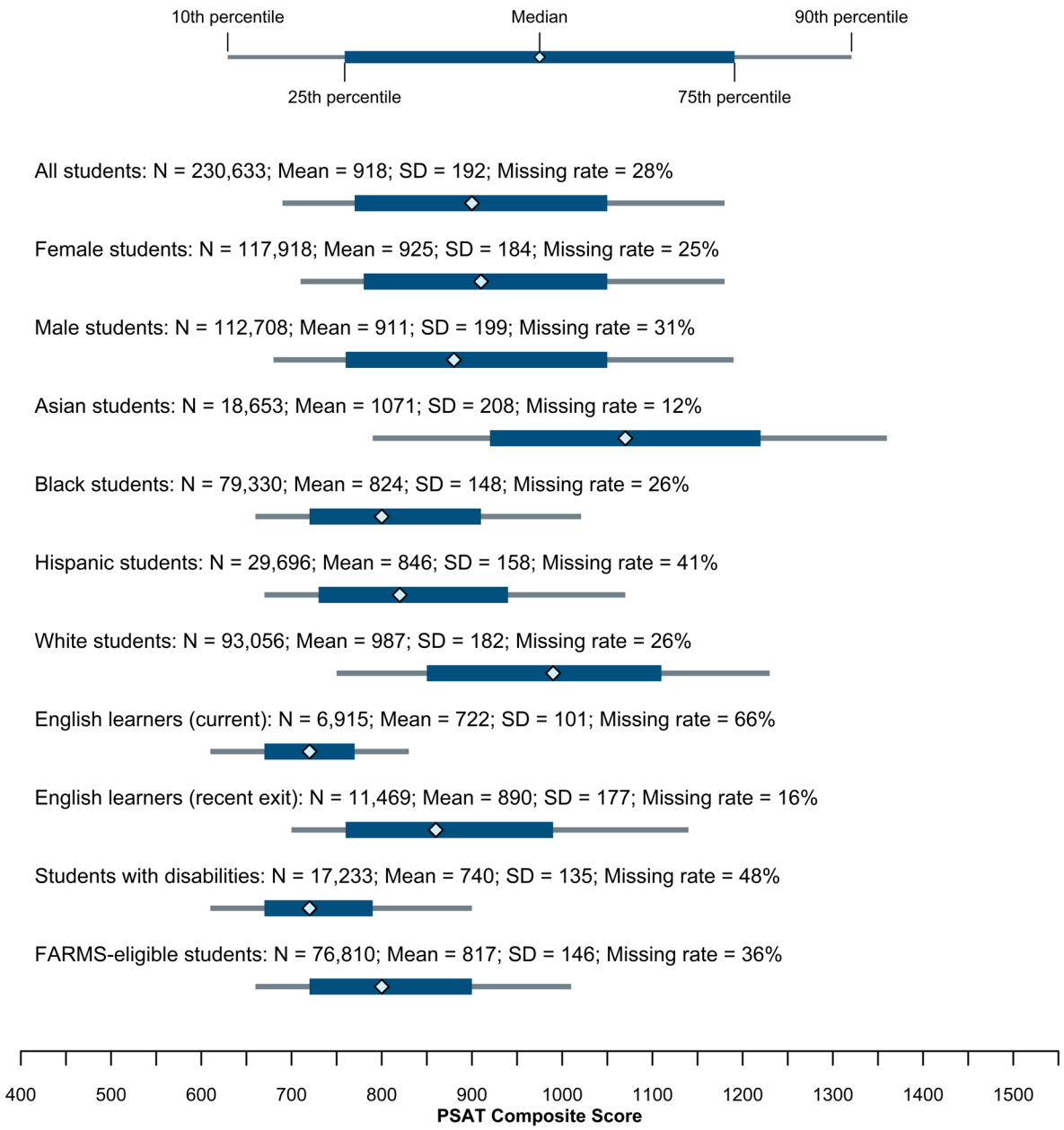
Note. FARMS = free and reduced-price meal services; HSY = high school year; PARCC = Partnership for Assessment of Readiness for College and Careers.

Exhibit T.10a. Distribution of PSAT Composite Scores at End of HSY2, by Initial Postsecondary Pathway



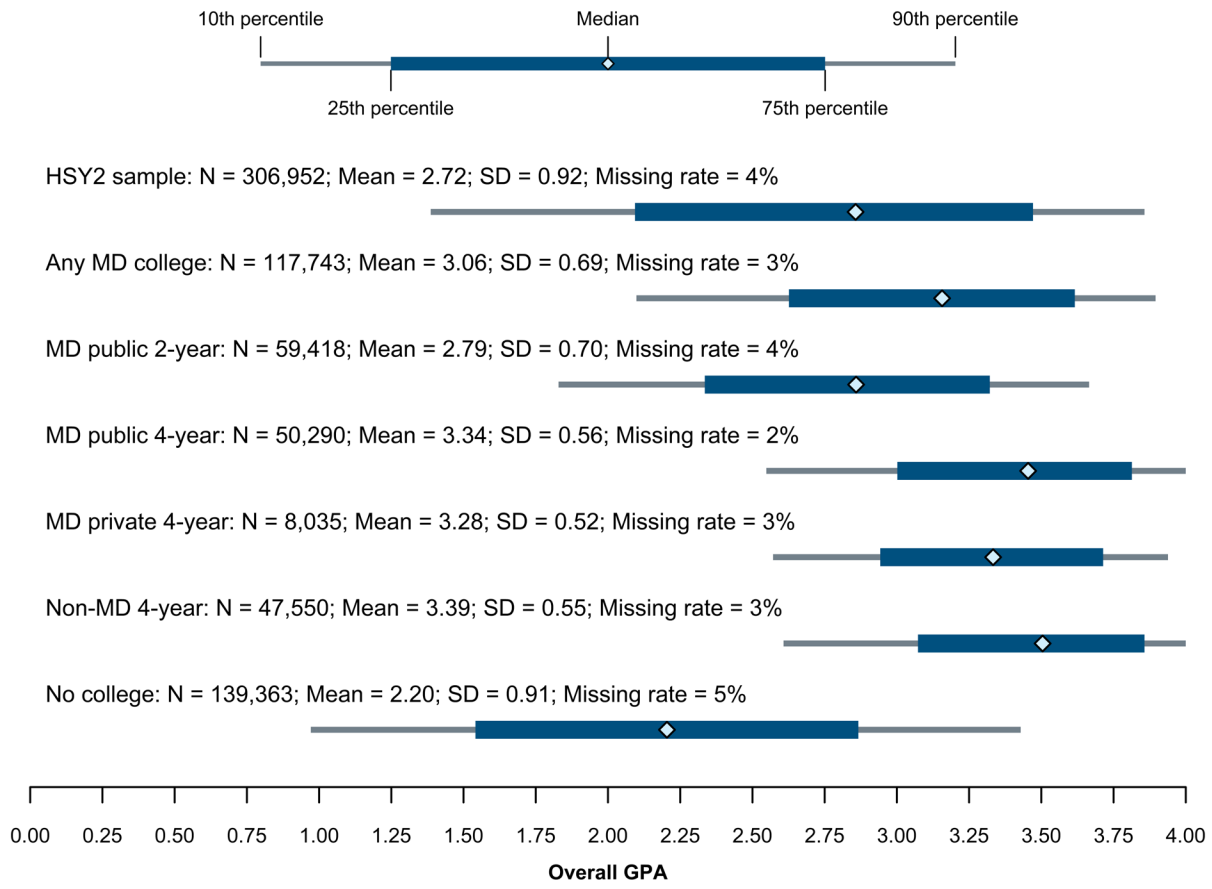
Note. HSY = high school year; MD = Maryland.

Exhibit T.10b. Distribution of PSAT Composite Scores at End of HSY2, by Student Characteristics



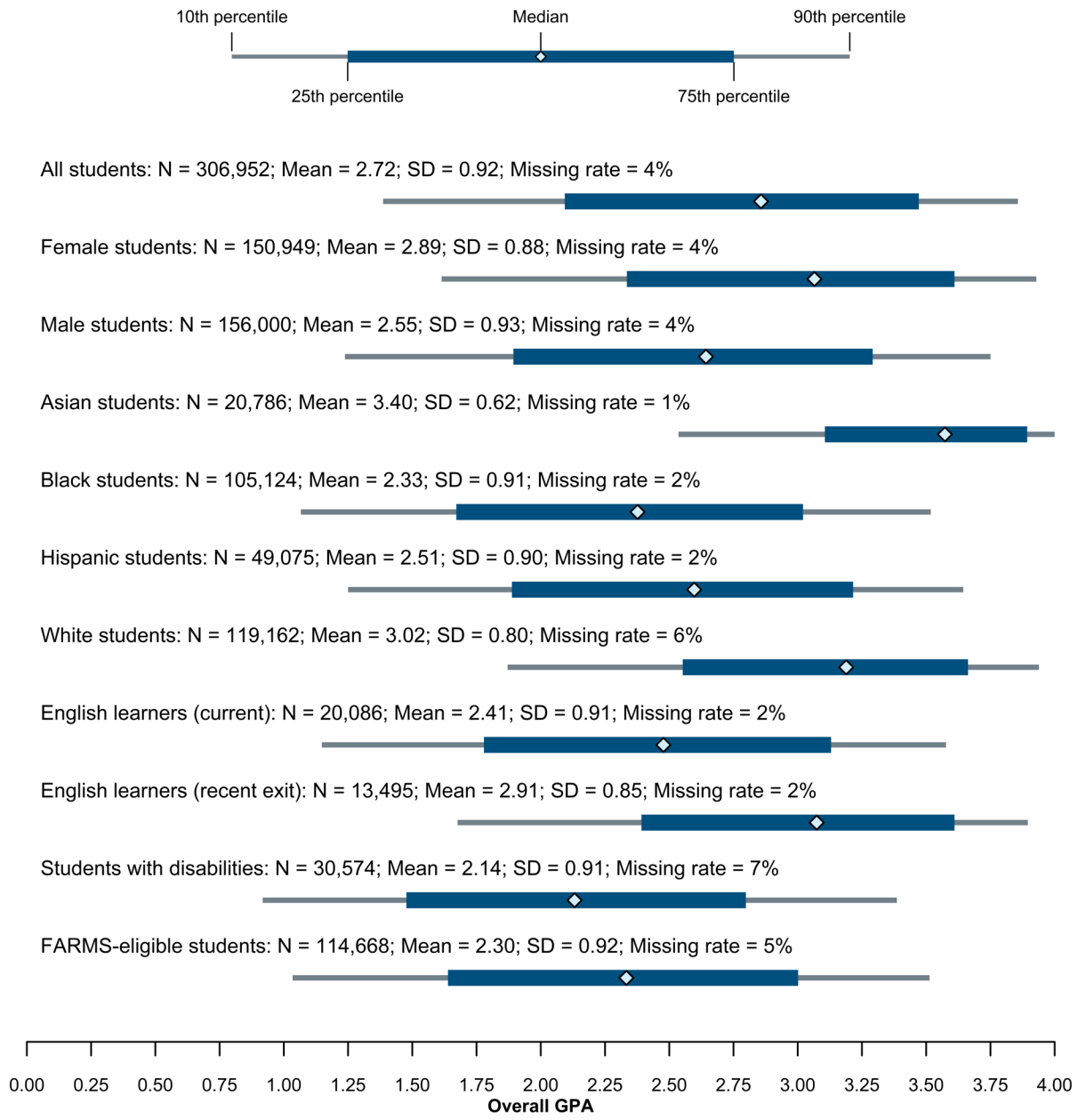
Note. FARMS = free and reduced-price meal services; HSY = high school year.

Exhibit T.11a. Distribution of Overall High School GPA at End of HSY2, by Initial Postsecondary Pathway



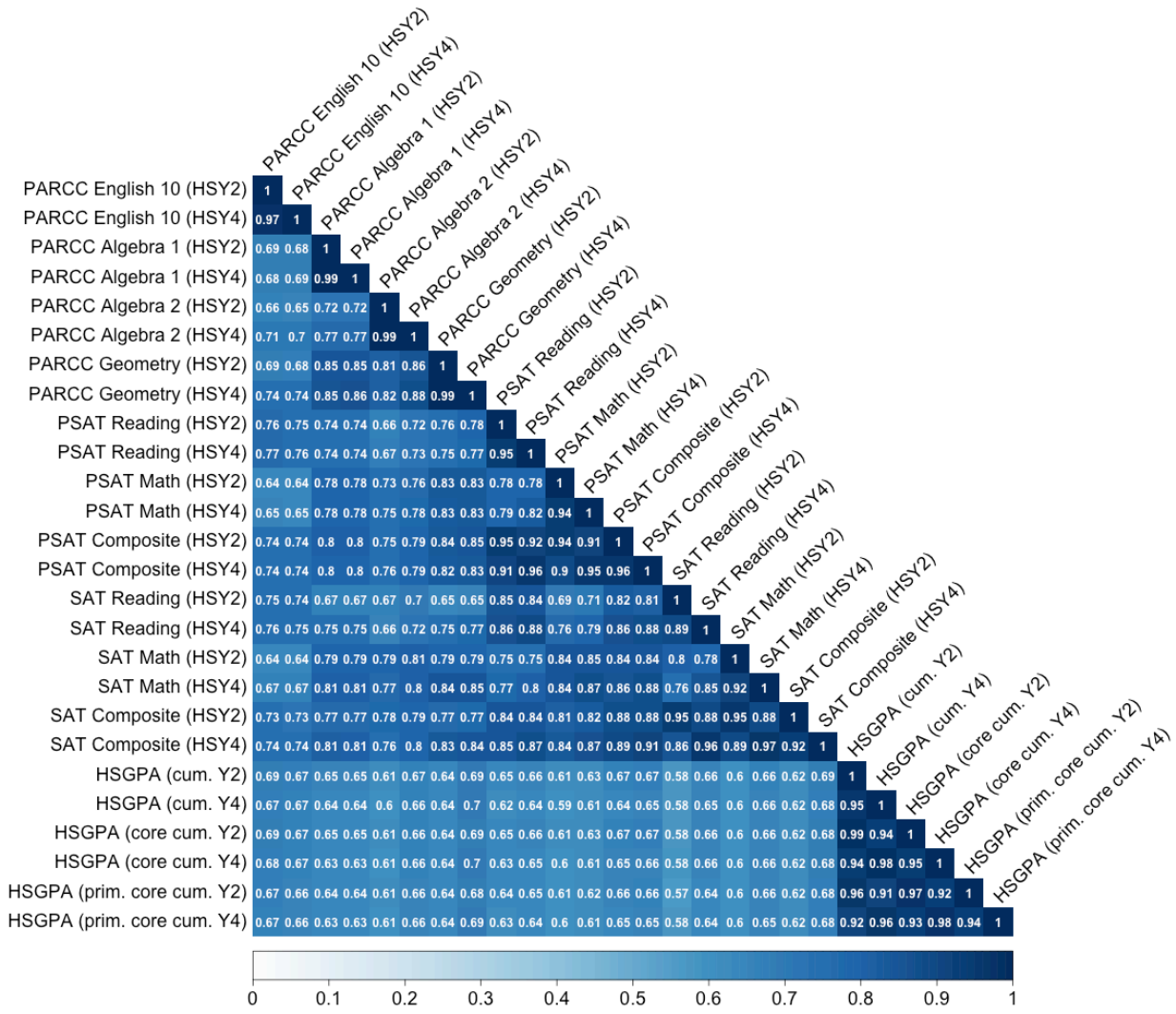
Note. HSY = high school year; MD = Maryland.

Exhibit T.11b. Distribution of Overall High School GPA at End of HSY2, by Student Characteristics



Note. FARMS = free and reduced-price meal services; HSY = high school year.

Exhibit T.12. Pairwise Correlations Between High School Measures of College and Career Readiness



Note. Correlations are based on all students in the HSY2 study sample who had nonmissing data for the measures included for a particular correlation coefficient. HSGPA = high school grade point average; HSY = high school year; PARCC = Partnership for Assessment of Readiness for College and Careers. For HSGPA, cum is the overall cumulative HSGPA, core cum is the cumulative HSGPA for core academic courses, and prim core cum is the cumulative HSGPA for primary core academic courses.

C.2. Relationship Between High School Measures of College and Career Readiness and Postsecondary Progress

To gauge the extent to which the four focal high school measures of CCR are predictive of postsecondary progress, we estimated the strength of the relationship (R^2) between each individual CCR measure and two measures of postsecondary progress: college credits awarded in the fall of the first postsecondary year and college GPA in the fall of the first postsecondary year.

The estimated strength of each relationship is in Exhibit T.13a, by initial postsecondary pathway, with parallel statistics for student groups in Exhibits T.13b and T.13c. The reported percentages represent the degree to which scores on one of the high school measures of CCR can predict performance on a measure of postsecondary progress, with higher values indicating a stronger relationship. To guide interpretation of the percentages, the following percentage ranges and corresponding descriptions can be used:

- < 10% is no meaningful relationship
- ≥ 10% and < 25% is a weak relationship
- ≥ 25% and < 50% is a moderate relationship
- ≥ 50% is a strong relationship

Exhibit T.13a. Strength of the Relationship Between High School Measures of College and Career Readiness and Postsecondary Progress, by Initial Postsecondary Pathway

Predicting College Credits Awarded in the First Postsecondary Semester (PSY1F)

	PARCC English 10	PARCC Algebra 1	PSAT composite	HSGPA overall
Any MD college	26%	27%	36%	30%
MD public 2-year	16%	15%	16%	21%
MD public 4-year	24%	27%	39%	26%
MD private 4-year	15%	15%	19%	16%

Predicting College GPA in the First Postsecondary Semester (PSY1F)

	PARCC English 10	PARCC Algebra 1	PSAT composite	HSGPA overall
Any MD college	16%	14%	16%	28%
MD public 2-year	10%	7%	8%	22%
MD public 4-year	16%	13%	16%	26%
MD private 4-year	14%	13%	14%	21%

Note. HSGPA = high school grade point average; MD = Maryland; PARCC = Partnership for Assessment of Readiness for College and Careers. PSY1F = postsecondary first-year fall term. Percentages reported in the table represent the percentage of variation (R^2) in the number of college credits awarded (top panel) or college GPA (bottom panel) during a student's fall semester after expected high school graduation associated with a particular high school measure of readiness at the end of the student's second year of high school. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

Exhibit T.13b. Strength of Relationship Between High School Measures of College and Career Readiness and College Credits Awarded in First Postsecondary Semester, by Student Characteristics

	PARCC English 10	PARCC Algebra 1	PSAT composite	HSGPA overall
All students	26%	27%	36%	30%
Female students	25%	26%	34%	29%
Male students	27%	29%	40%	32%
Asian students	29%	34%	46%	29%
Black students	18%	14%	19%	22%
Hispanic students	21%	20%	26%	23%
White students	23%	23%	32%	30%
English learners (current)	10%	13%	13%	15%
English learners (recent exit)	22%	26%	33%	24%
Students with disabilities	18%	14%	19%	18%
FARMS-eligible students	19%	17%	22%	23%

Note. FARMS = free and reduced-price meal services; HSGPA = high school grade point average; PARCC = Partnership for Assessment of Readiness for College and Careers. Percentages reported in the table represent the percentage of variation (R^2) in the number of college credits awarded during a student's fall semester after expected high school graduation associated with a particular high school measure of readiness at the end of the student's second year of high school. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

Exhibit T.13c. Strength of Relationship Between High School Measures of College and Career Readiness and College GPA in First Postsecondary Semester, by Student Characteristics

	PARCC English 10	PARCC Algebra 1	PSAT composite	HSGPA overall
All students	16%	14%	16%	28%
Female students	16%	15%	17%	28%
Male students	16%	14%	17%	28%
Asian students	14%	13%	14%	25%
Black students	12%	8%	10%	22%
Hispanic students	11%	8%	10%	19%
White students	12%	10%	11%	27%
English learners (current)	6%	5%	4%	14%
English learners (recent exit)	13%	11%	14%	23%
Students with disabilities	7%	5%	5%	16%
FARMS-eligible students	12%	8%	10%	21%

Note. FARMS = free and reduced-price meal services; HSGPA = high school grade point average; PARCC = Partnership for Assessment of Readiness for College and Careers. Percentages reported in the table represent the percentage of variation (R^2) in a student's college GPA for the fall semester after expected high school graduation associated with a particular high school measure of readiness at the end of the student's second year of high school. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

To better understand the predictive power of high school measures of CCR, it is useful to look at how well they jointly predict postsecondary progress. To do this, we estimated a series of multivariate linear regression models to see how the percentage of variance (adjusted R^2) explained changes based on different combinations of measures. In particular, we compared the following combinations:

- Model 1: PARCC English 10 + PARCC Algebra 1
- Model 2: PARCC English 10 + PARCC Algebra 1 + PSAT composite

- Model 3: PARCC English 10 + PARCC Algebra 1 + overall HSGPA
- Model 4: PARCC English 10 + PARCC Algebra 1 + PSAT composite + overall HSGPA

The estimated predictive power of each model is in Exhibit T.14a, by initial postsecondary pathway, with parallel statistics for student groups in Exhibits T.14b and T.14c. Overall, the results show a small increase in the ability to predict postsecondary progress when including PSAT and/or HSGPA in a model with the English 10 and Algebra 1 state assessment scores. For credits awarded, the percentage of variance predicted improves from 33% when PARCC English 10 and PARCC Algebra 1 are considered to 42% when PSAT and HSGPA also are considered. Similarly, the percentage of variance predicted improves from 19% to 30% when looking at college GPA. For the relationships estimated within each initial postsecondary pathway, the improvement is primarily driven by the inclusion of HSGPA rather than PSAT, except for credits awarded in Maryland public 4-year colleges. For each student group examined, the percentage of variance predicted improved by at least 4 percentage points with the inclusion of PSAT and HSGPA.[1]

[1] One concern about comparing results across the four models is that the number of students included in the estimation of each model changes based on which students have nonmissing scores for the measures included in a given model. Therefore, some of the difference in results across models could be the result of differences in the students included in the estimation. To examine this concern, we conducted a supplemental analysis that estimated all four models on a stable sample of students with available data for all the measures. The findings based on the stable student sample were very similar to what we report for our main analysis.

Exhibit T.14a. Strength of the Relationship Between Combinations of High School Measures of College and Career Readiness and Postsecondary Progress, by Initial Postsecondary Pathway

Predicting College Credits Awarded in the First Postsecondary Semester (PSY1F)

	Model 1: PARCC only	Model 2: +PSAT	Model 3: +HSGPA	Model 4: +PSAT+HSGPA
Any MD college	33%	38%	38%	42%
MD public 2-year	20%	21%	26%	26%
MD public 4-year	32%	39%	35%	42%
MD private 4-year	19%	22%	22%	24%

Predicting College GPA in the First Postsecondary Semester (PSY1F)

	Model 1: PARCC only	Model 2: +PSAT	Model 3: +HSGPA	Model 4: +PSAT+HSGPA
Any MD college	19%	20%	29%	30%
MD public 2-year	11%	11%	22%	23%
MD public 4-year	18%	19%	27%	28%
MD private 4-year	18%	18%	25%	25%

Note. HSGPA = high school grade point average; MD = Maryland; PARCC = Partnership for Assessment of Readiness for College and Careers; PSY1F = postsecondary first-year fall term. Percentages reported in the table represent the percentage of variation (adjusted R^2) in the number of college credits awarded (top panel) or college GPA (bottom panel) during a student's fall semester after expected high school graduation that was predicted by the measures in a given model. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

Exhibit T.14b. Strength of Relationship Between Combinations of High School Measures of College and Career Readiness and College Credits Awarded in First Postsecondary Semester, by Student Characteristics

	Model 1: PARCC only	Model 2: +PSAT	Model 3: +HSGPA	Model 4: +PSAT+HSGPA
All students	33%	38%	38%	42%
Female students	32%	36%	36%	40%
Male students	35%	41%	40%	45%
Asian students	41%	47%	44%	50%
Black students	20%	22%	27%	28%
Hispanic students	26%	30%	31%	34%
White students	30%	35%	37%	41%
English learners (current)	16%	17%	21%	22%
English learners (recent exit)	31%	36%	35%	38%
Students with disabilities	20%	23%	25%	28%
FARMS-eligible students	23%	26%	29%	31%

Note. FARMS = free and reduced-price meal services; HSGPA = high school grade point average; PARCC = Partnership for Assessment of Readiness for College and Careers. Percentages reported in the table represent the percentage of variation (adjusted R^2) in the number of college credits awarded during a student's fall semester after expected high school graduation that was predicted by the measures in a given model. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

Exhibit T.14c. Strength of Relationship Between Combinations of High School Measures of College and Career Readiness and College GPA in First Postsecondary Semester, by Student Characteristics

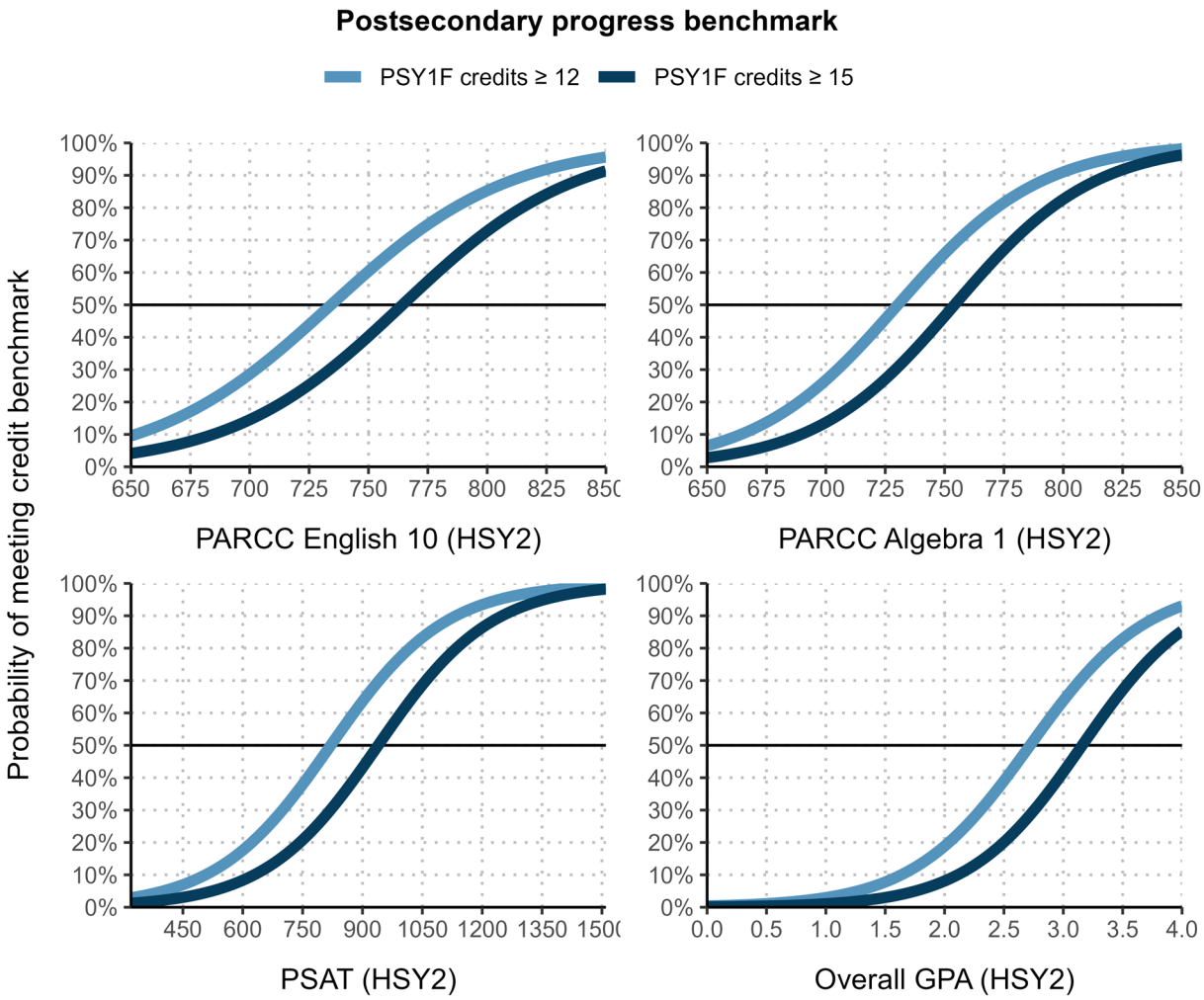
	Model 1: PARCC only	Model 2: +PSAT	Model 3: +HSGPA	Model 4: +PSAT+HSGPA
All students	19%	20%	29%	30%
Female students	19%	20%	29%	29%
Male students	19%	20%	29%	30%
Asian students	17%	17%	27%	27%
Black students	13%	14%	23%	23%
Hispanic students	12%	13%	20%	21%
White students	15%	15%	28%	28%
English learners (current)	7%	6%	12%	11%
English learners (recent exit)	16%	17%	24%	25%
Students with disabilities	8%	8%	16%	17%
FARMS-eligible students	13%	13%	22%	23%

Note. FARMS = free and reduced-price meal services; HSGPA = high school grade point average; PARCC = Partnership for Assessment of Readiness for College and Careers. Percentages reported in the table represent the percentage of variation (adjusted R^2) in a student's college GPA for the fall semester after expected high school graduation that was predicted by the measures in a given model. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

To examine how high school measures of CCR predict postsecondary progress, we estimated the predicted probability of meeting specific postsecondary progress benchmarks across the range of values for the high school measures of CCR. The overall results are in Exhibits T.15a and T.15b. The plots show the positive relationship between each high school measure and each postsecondary progress benchmark, with higher values on a measure corresponding to a greater probability of meeting a benchmark. Lines with a steeper slope indicate a stronger relationship than do lines with flatter slopes. More stringent definitions of postsecondary progress (e.g., at least 15 credits awarded instead of 12) correspond with higher scores on the

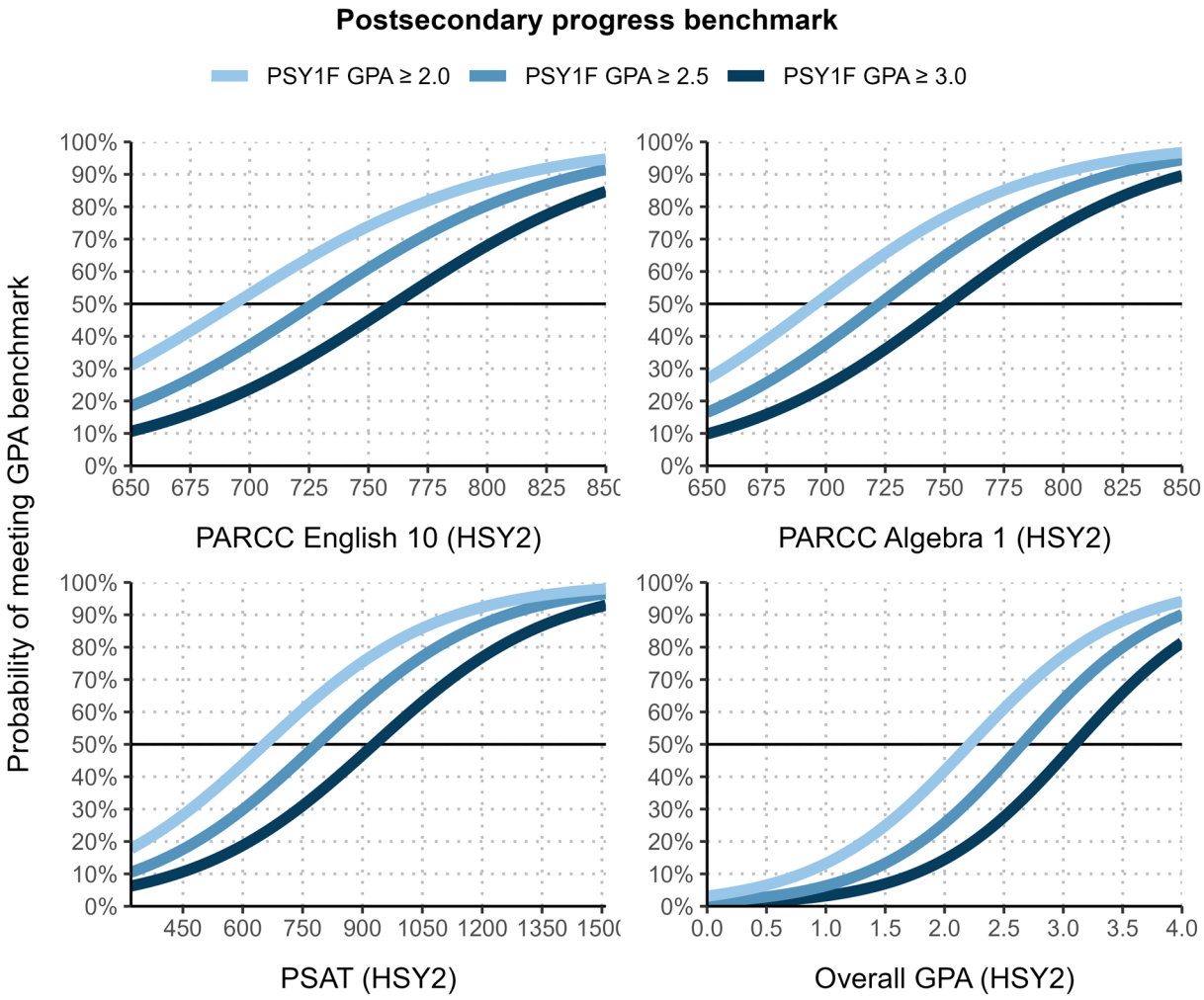
high school measures. Across the different postsecondary progress benchmarks, the following thresholds for the high school measures of CCR were associated with students having at least a 50% chance of meeting postsecondary progress benchmarks: scoring proficient on the English 10 and Algebra 1 state assessments (750 for PARCC), achieving a PSAT composite score of about 900, and having an overall HSGPA of about 3.0.

Exhibit T.15a. Predicted Probabilities of Meeting College Credit Benchmarks in First Postsecondary Semester for High School Measures of College and Career Readiness



Note. HSY = high school year; PARCC = Partnership for Assessment of Readiness for College and Careers; PSY1F = postsecondary first-year fall term.

Exhibit T.15b. Predicted Probabilities of Meeting College GPA Benchmarks in First Postsecondary Semester for High School Measures of College and Career Readiness



Note. HSY = high school year; PARCC = Partnership for Assessment of Readiness for College and Careers; PSY1F = postsecondary first-year fall term.

C.3. Predictive Validity of the Interim CCR Standard and Alternative CCR Standards

This section provides estimates of the accuracy, sensitivity, and specificity rates for the interim CCR standard and the three alternative CCR standards examined for the interim report:

- Alternative 1: Meeting the interim CCR standard or a PSAT composite score ≥ 1000
- Alternative 2: Meeting the interim CCR standard or an overall HSGPA ≥ 3.0
- Alternative 3: Meeting the interim CCR standard or a PSAT composite score ≥ 1000 or an overall HSGPA ≥ 3.0

Exhibit T.16a. Accuracy, Sensitivity, and Specificity Rates for the Interim and Alternative CCR Standards, by Initial Postsecondary Pathway and Postsecondary Progress Benchmark

Sample	Progress benchmark	*N*	Interim standard			Alternative 1			Alternative 2			Alternative 3		
			Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe
Any MD college	PSY1F credits ≥ 12	117,819	65%	54%	83%	68%	62%	79%	75%	81%	64%	75%	83%	62%
	PSY1F credits ≥ 15	117,819	70%	61%	78%	71%	69%	73%	70%	86%	55%	70%	88%	53%
	PSY1S credits ≥ 24	84,436	65%	56%	82%	69%	65%	78%	75%	83%	61%	76%	85%	59%
	PSY1S credits ≥ 30	84,436	71%	64%	77%	73%	74%	71%	69%	90%	52%	69%	91%	49%
	PSY1F GPA ≥ 2.0	116,589	56%	48%	79%	60%	55%	75%	72%	75%	63%	72%	76%	60%
	PSY1F GPA ≥ 2.5	116,589	61%	51%	77%	64%	59%	72%	71%	78%	58%	71%	80%	55%
	PSY1F GPA ≥ 3.0	116,589	64%	55%	73%	65%	63%	68%	67%	82%	51%	66%	83%	49%
	PSY1S GPA ≥ 2.0	84,255	54%	48%	81%	59%	55%	75%	73%	75%	65%	74%	77%	62%
	PSY1S GPA ≥ 2.5	84,255	60%	51%	78%	64%	60%	73%	73%	79%	60%	73%	81%	57%
	PSY1S GPA ≥ 3.0	84,255	65%	57%	74%	67%	66%	68%	69%	85%	52%	68%	86%	49%
MD public 2-year	PSY1F credits ≥ 12	59,209	67%	43%	85%	68%	49%	82%	69%	73%	67%	69%	75%	65%
	PSY1F credits ≥ 15	59,209	72%	49%	81%	71%	56%	77%	65%	78%	60%	64%	80%	58%
	PSY1S credits ≥ 24	39,691	68%	44%	84%	69%	52%	81%	69%	76%	64%	68%	78%	62%
	PSY1S credits ≥ 30	39,691	74%	53%	80%	72%	61%	76%	63%	83%	57%	61%	84%	54%
	PSY1F GPA ≥ 2.0	58,034	51%	34%	83%	53%	39%	80%	64%	61%	69%	64%	63%	66%
	PSY1F GPA ≥ 2.5	58,034	58%	36%	82%	59%	42%	78%	66%	66%	66%	66%	68%	63%
	PSY1F GPA ≥ 3.0	58,034	63%	39%	80%	63%	44%	76%	64%	69%	61%	63%	70%	59%
	PSY1S GPA ≥ 2.0	39,524	47%	32%	85%	50%	38%	81%	64%	62%	72%	65%	64%	69%
	PSY1S GPA ≥ 2.5	39,524	56%	36%	83%	57%	41%	79%	67%	67%	67%	67%	69%	64%
	PSY1S GPA ≥ 3.0	39,524	64%	40%	81%	64%	46%	77%	66%	73%	61%	65%	74%	59%
MD public 4-year	PSY1F credits ≥ 12	50,533	64%	62%	75%	71%	71%	69%	81%	86%	52%	82%	87%	50%
	PSY1F credits ≥ 15	50,533	68%	67%	69%	73%	77%	63%	76%	90%	42%	76%	91%	40%
	PSY1S credits ≥ 24	38,487	64%	62%	74%	72%	72%	67%	82%	87%	51%	82%	88%	48%
	PSY1S credits ≥ 30	38,487	69%	69%	69%	74%	80%	61%	75%	92%	41%	75%	94%	39%
	PSY1F GPA ≥ 2.0	50,514	62%	60%	69%	68%	69%	62%	79%	85%	48%	80%	86%	45%
	PSY1F GPA ≥ 2.5	50,514	64%	63%	66%	69%	72%	59%	77%	87%	43%	77%	89%	40%
	PSY1F GPA ≥ 3.0	50,514	65%	67%	62%	68%	76%	54%	69%	90%	36%	69%	91%	33%
	PSY1S GPA ≥ 2.0	38,479	61%	60%	70%	69%	70%	62%	81%	85%	49%	82%	86%	46%
	PSY1S GPA ≥ 2.5	38,479	64%	63%	68%	70%	73%	60%	79%	88%	45%	80%	89%	42%
	PSY1S GPA ≥ 3.0	38,479	66%	68%	63%	69%	78%	54%	72%	91%	37%	71%	92%	34%

Sample	Progress benchmark	*N*	Interim standard			Alternative 1			Alternative 2			Alternative 3		
			Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe
MD private 4-year	PSY1F credits ≥ 12	8,077	55%	51%	81%	60%	58%	76%	79%	82%	53%	79%	84%	50%
	PSY1F credits ≥ 15	8,077	61%	55%	75%	65%	63%	70%	73%	86%	42%	74%	87%	40%
	PSY1S credits ≥ 24	6,258	54%	50%	78%	60%	58%	72%	78%	83%	49%	79%	84%	46%
	PSY1S credits ≥ 30	6,258	61%	55%	74%	65%	64%	69%	73%	87%	41%	73%	88%	39%
	PSY1F GPA ≥ 2.0	8,041	54%	51%	75%	60%	58%	70%	78%	83%	49%	78%	84%	46%
	PSY1F GPA ≥ 2.5	8,041	59%	54%	75%	64%	62%	70%	75%	86%	45%	76%	87%	43%
	PSY1F GPA ≥ 3.0	8,041	64%	59%	71%	66%	67%	65%	68%	90%	38%	68%	91%	36%
	PSY1S GPA ≥ 2.0	6,252	52%	49%	75%	58%	57%	68%	78%	82%	49%	79%	83%	45%
	PSY1S GPA ≥ 2.5	6,252	58%	53%	76%	63%	61%	70%	78%	86%	48%	78%	87%	45%
	PSY1S GPA ≥ 3.0	6,252	65%	59%	73%	67%	68%	67%	69%	90%	39%	69%	91%	36%

Note. Acc = accuracy rate; GPA = grade point average; MD = Maryland; PSY1F = postsecondary first-year fall term; PSY1S = postsecondary first-year spring term; Sen = sensitivity rate; Spe = specificity rate. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

Exhibit T.16b. Accuracy, Sensitivity, and Specificity Rates for the Interim and Alternative CCR Standards, by Gender and Postsecondary Progress Benchmark

Sample	Progress benchmark	*N*	Interim standard			Alternative 1			Alternative 2			Alternative 3		
			Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe
Female students	PSY1F credits ≥ 12	63,618	63%	52%	85%	67%	59%	82%	76%	82%	62%	76%	83%	61%
	PSY1F credits ≥ 15	63,618	69%	59%	80%	71%	66%	76%	70%	87%	53%	70%	88%	51%
	PSY1S credits ≥ 24	46,128	64%	54%	84%	68%	62%	81%	76%	84%	59%	76%	86%	58%
	PSY1S credits ≥ 30	46,128	70%	62%	78%	73%	71%	74%	69%	90%	49%	69%	91%	48%
	PSY1F GPA ≥ 2.0	63,000	54%	46%	82%	58%	53%	78%	73%	76%	62%	74%	77%	60%
	PSY1F GPA ≥ 2.5	63,000	59%	50%	80%	62%	56%	76%	73%	80%	57%	73%	80%	55%
	PSY1F GPA ≥ 3.0	63,000	63%	53%	76%	65%	60%	71%	68%	83%	50%	67%	83%	48%
	PSY1S GPA ≥ 2.0	46,040	52%	46%	83%	57%	53%	79%	75%	76%	65%	75%	78%	63%
	PSY1S GPA ≥ 2.5	46,040	58%	50%	81%	62%	57%	77%	75%	80%	59%	75%	81%	57%
	PSY1S GPA ≥ 3.0	46,040	65%	55%	77%	67%	63%	72%	70%	85%	50%	70%	86%	49%
Male students	PSY1F credits ≥ 12	54,199	66%	57%	81%	70%	66%	77%	74%	79%	65%	74%	82%	63%
	PSY1F credits ≥ 15	54,199	70%	64%	76%	72%	74%	71%	70%	85%	57%	69%	87%	54%
	PSY1S credits ≥ 24	38,308	67%	58%	80%	71%	69%	75%	75%	82%	63%	75%	84%	60%
	PSY1S credits ≥ 30	38,308	71%	66%	75%	72%	78%	68%	69%	89%	54%	68%	90%	51%
	PSY1F GPA ≥ 2.0	53,587	58%	50%	77%	62%	58%	72%	70%	72%	63%	70%	75%	60%
	PSY1F GPA ≥ 2.5	53,587	62%	54%	75%	65%	62%	69%	70%	77%	59%	69%	79%	56%
	PSY1F GPA ≥ 3.0	53,587	65%	58%	71%	65%	67%	64%	65%	81%	53%	64%	82%	50%
	PSY1S GPA ≥ 2.0	38,215	56%	49%	78%	62%	59%	72%	71%	73%	65%	72%	75%	61%
	PSY1S GPA ≥ 2.5	38,215	62%	54%	76%	65%	63%	69%	72%	78%	60%	72%	80%	56%
	PSY1S GPA ≥ 3.0	38,215	66%	60%	72%	67%	70%	64%	67%	84%	53%	66%	85%	49%

Note. Acc = accuracy rate; GPA = grade point average; PSY1F = postsecondary first-year fall term; PSY1S = postsecondary first-year spring term; Sen = sensitivity rate; Spe = specificity rate. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

Exhibit T.16c. Accuracy, Sensitivity, and Specificity Rates for the Interim and Alternative CCR Standards, by Race/Ethnicity and Postsecondary Progress Benchmark

Sample	Progress benchmark	*N*	Interim standard			Alternative 1			Alternative 2			Alternative 3		
			Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe
Asian students	PSY1F credits ≥ 12	13,201	70%	68%	74%	77%	79%	68%	83%	92%	42%	83%	94%	39%
	PSY1F credits ≥ 15	13,201	71%	73%	67%	76%	84%	59%	74%	95%	32%	74%	96%	30%
	PSY1S credits ≥ 24	9,965	70%	68%	75%	77%	80%	68%	83%	93%	41%	83%	94%	38%
	PSY1S credits ≥ 30	9,965	71%	74%	67%	76%	85%	59%	74%	96%	32%	74%	97%	29%
	PSY1F GPA ≥ 2.0	13,144	64%	64%	65%	72%	74%	56%	83%	90%	39%	84%	91%	35%
	PSY1F GPA ≥ 2.5	13,144	65%	66%	61%	71%	76%	52%	79%	91%	34%	79%	92%	30%
	PSY1F GPA ≥ 3.0	13,144	65%	69%	56%	68%	79%	47%	71%	93%	27%	70%	94%	24%
	PSY1S GPA ≥ 2.0	9,947	63%	63%	69%	72%	73%	59%	85%	89%	43%	86%	91%	39%
	PSY1S GPA ≥ 2.5	9,947	65%	65%	66%	72%	76%	56%	82%	91%	37%	82%	92%	33%
	PSY1S GPA ≥ 3.0	9,947	66%	69%	60%	70%	79%	50%	74%	94%	30%	73%	95%	26%
Black students	PSY1F credits ≥ 12	37,232	60%	30%	92%	63%	37%	90%	70%	64%	77%	70%	65%	76%
	PSY1F credits ≥ 15	37,232	71%	36%	89%	72%	44%	87%	70%	71%	70%	70%	72%	69%
	PSY1S credits ≥ 24	25,720	61%	32%	91%	64%	39%	89%	71%	67%	75%	71%	69%	73%
	PSY1S credits ≥ 30	25,720	74%	41%	88%	74%	50%	85%	70%	77%	67%	69%	79%	65%
	PSY1F GPA ≥ 2.0	36,702	48%	25%	90%	50%	30%	88%	63%	56%	77%	63%	57%	75%
	PSY1F GPA ≥ 2.5	36,702	57%	28%	89%	59%	33%	86%	66%	60%	73%	66%	62%	71%
	PSY1F GPA ≥ 3.0	36,702	66%	30%	87%	66%	36%	83%	66%	64%	67%	66%	66%	66%
	PSY1S GPA ≥ 2.0	25,633	44%	25%	91%	47%	31%	87%	62%	56%	78%	63%	58%	76%
	PSY1S GPA ≥ 2.5	25,633	55%	28%	89%	57%	34%	86%	67%	62%	73%	67%	64%	71%
	PSY1S GPA ≥ 3.0	25,633	67%	33%	87%	67%	40%	83%	68%	69%	67%	67%	71%	65%
Hispanic students	PSY1F credits ≥ 12	13,381	63%	43%	87%	66%	50%	84%	70%	78%	62%	70%	79%	60%
	PSY1F credits ≥ 15	13,381	71%	49%	83%	72%	57%	80%	66%	84%	55%	65%	85%	53%
	PSY1S credits ≥ 24	9,032	64%	44%	86%	67%	52%	83%	70%	80%	60%	70%	81%	59%
	PSY1S credits ≥ 30	9,032	72%	53%	82%	72%	62%	78%	64%	86%	53%	63%	88%	51%
	PSY1F GPA ≥ 2.0	13,225	49%	34%	84%	52%	40%	80%	67%	68%	62%	67%	70%	60%
	PSY1F GPA ≥ 2.5	13,225	56%	37%	82%	58%	43%	78%	66%	72%	58%	66%	73%	56%
	PSY1F GPA ≥ 3.0	13,225	61%	40%	80%	62%	45%	75%	63%	74%	53%	62%	76%	51%
	PSY1S GPA ≥ 2.0	9,013	45%	33%	83%	48%	39%	79%	67%	68%	65%	68%	69%	63%
	PSY1S GPA ≥ 2.5	9,013	53%	36%	82%	56%	43%	78%	68%	72%	61%	68%	74%	59%
	PSY1S GPA ≥ 3.0	9,013	62%	41%	80%	62%	47%	75%	65%	77%	55%	65%	78%	52%

Sample	Progress benchmark	*N*	Interim standard			Alternative 1			Alternative 2			Alternative 3		
			Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe
White students	PSY1F credits ≥ 12	49,007	66%	65%	71%	71%	73%	65%	78%	87%	51%	78%	89%	48%
	PSY1F credits ≥ 15	49,007	67%	69%	65%	70%	78%	58%	70%	91%	42%	70%	92%	39%
	PSY1S credits ≥ 24	36,212	67%	65%	70%	72%	75%	64%	78%	89%	49%	78%	90%	45%
	PSY1S credits ≥ 30	36,212	68%	71%	64%	70%	81%	57%	69%	92%	39%	68%	94%	36%
	PSY1F GPA ≥ 2.0	48,566	61%	60%	65%	66%	68%	58%	76%	83%	48%	77%	85%	44%
	PSY1F GPA ≥ 2.5	48,566	63%	62%	63%	67%	71%	56%	74%	86%	44%	74%	87%	40%
	PSY1F GPA ≥ 3.0	48,566	63%	66%	60%	65%	74%	52%	67%	88%	38%	66%	89%	34%
	PSY1S GPA ≥ 2.0	36,161	60%	59%	67%	67%	68%	60%	79%	83%	51%	80%	85%	46%
	PSY1S GPA ≥ 2.5	36,161	63%	62%	65%	68%	71%	58%	77%	86%	46%	77%	87%	42%
	PSY1S GPA ≥ 3.0	36,161	64%	66%	61%	67%	75%	53%	70%	89%	38%	69%	91%	35%

Note. Acc = accuracy rate; GPA = grade point average; PSY1F = postsecondary first-year fall term; PSY1S = postsecondary first-year spring term; Sen = sensitivity rate; Spe = specificity rate. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

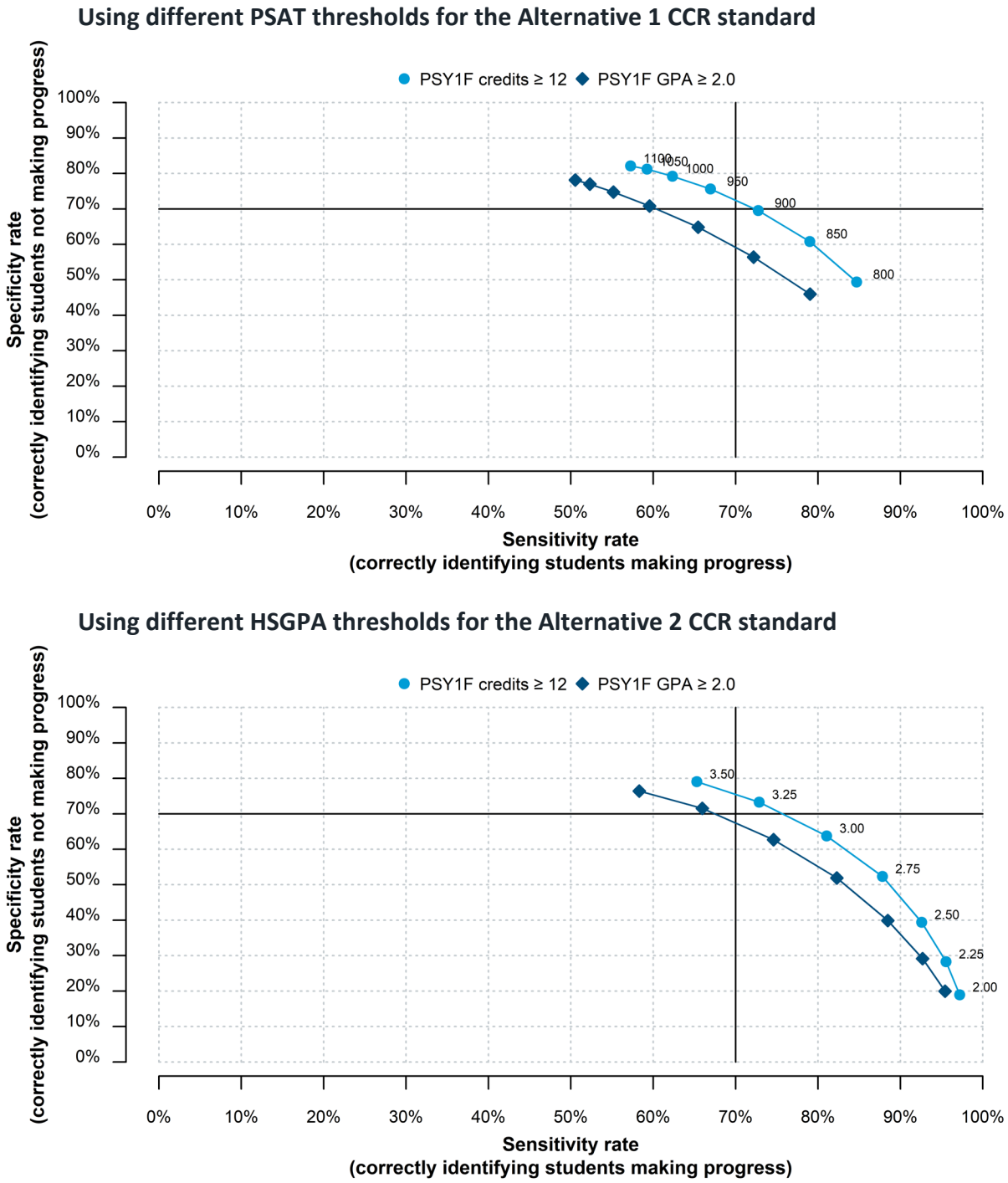
Exhibit T.16d. Accuracy, Sensitivity, and Specificity Rates for the Interim and Alternative CCR Standards, by Student Group and Postsecondary Progress Benchmark

	Progress		Interim standard			Alternative 1			Alternative 2			Alternative 3		
Sample	benchmark	*N*	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe
English learners (current)	PSY1F credits ≥ 12	2,532	63%	6%	100%	64%	8%	99%	64%	78%	56%	64%	78%	55%
	PSY1F credits ≥ 15	2,532	77%	7%	99%	77%	11%	98%	58%	82%	50%	58%	82%	50%
	PSY1S credits ≥ 24	1,665	64%	6%	100%	65%	9%	99%	63%	80%	52%	62%	81%	51%
	PSY1S credits ≥ 30	1,665	78%	8%	99%	79%	13%	99%	56%	86%	47%	56%	86%	47%
	PSY1F GPA ≥ 2.0	2,416	37%	4%	100%	38%	6%	99%	65%	69%	59%	65%	69%	58%
	PSY1F GPA ≥ 2.5	2,416	49%	4%	100%	49%	6%	99%	64%	71%	55%	64%	71%	55%
	PSY1F GPA ≥ 3.0	2,416	62%	5%	99%	62%	7%	98%	58%	72%	49%	58%	73%	49%
	PSY1S GPA ≥ 2.0	1,633	27%	3%	100%	29%	5%	99%	67%	69%	62%	67%	69%	62%
	PSY1S GPA ≥ 2.5	1,633	42%	4%	100%	43%	6%	99%	64%	71%	54%	64%	72%	54%
	PSY1S GPA ≥ 3.0	1,633	61%	5%	99%	61%	7%	99%	59%	75%	48%	59%	75%	48%
English learners (recent exit)	PSY1F credits ≥ 12	6,420	62%	48%	85%	65%	54%	83%	73%	86%	50%	73%	87%	49%
	PSY1F credits ≥ 15	6,420	69%	55%	80%	70%	62%	77%	64%	90%	41%	63%	91%	40%
	PSY1S credits ≥ 24	3,005	62%	44%	90%	65%	51%	87%	73%	87%	52%	73%	88%	50%
	PSY1S credits ≥ 30	3,005	71%	52%	85%	72%	60%	81%	63%	91%	42%	63%	92%	41%
	PSY1F GPA ≥ 2.0	6,382	51%	42%	82%	54%	47%	79%	74%	81%	52%	74%	81%	51%
	PSY1F GPA ≥ 2.5	6,382	57%	45%	81%	60%	51%	78%	71%	84%	47%	71%	84%	46%
	PSY1F GPA ≥ 3.0	6,382	62%	48%	78%	63%	54%	74%	66%	86%	42%	65%	87%	41%
	PSY1S GPA ≥ 2.0	3,000	45%	35%	87%	49%	41%	84%	76%	79%	60%	76%	80%	58%
	PSY1S GPA ≥ 2.5	3,000	52%	38%	85%	56%	45%	82%	73%	82%	52%	73%	83%	51%
	PSY1S GPA ≥ 3.0	3,000	62%	44%	84%	64%	51%	80%	68%	87%	45%	67%	87%	44%
Students with disabilities	PSY1F credits ≥ 12	6,016	75%	20%	95%	75%	25%	94%	71%	59%	76%	71%	60%	75%
	PSY1F credits ≥ 15	6,016	85%	28%	95%	84%	34%	93%	71%	67%	72%	71%	68%	71%
	PSY1S credits ≥ 24	3,861	77%	24%	95%	77%	29%	94%	71%	65%	74%	71%	67%	73%
	PSY1S credits ≥ 30	3,861	85%	32%	94%	85%	40%	92%	69%	72%	69%	69%	74%	68%
	PSY1F GPA ≥ 2.0	5,797	49%	13%	95%	50%	16%	94%	60%	45%	79%	60%	47%	78%
	PSY1F GPA ≥ 2.5	5,797	61%	14%	94%	61%	18%	93%	66%	50%	77%	65%	51%	76%
	PSY1F GPA ≥ 3.0	5,797	70%	15%	93%	70%	19%	92%	67%	52%	73%	66%	53%	72%
	PSY1S GPA ≥ 2.0	3,821	42%	12%	95%	44%	15%	93%	59%	46%	80%	59%	47%	78%
	PSY1S GPA ≥ 2.5	3,821	56%	14%	94%	57%	17%	92%	66%	53%	78%	66%	54%	76%
	PSY1S GPA ≥ 3.0	3,821	70%	17%	93%	70%	21%	92%	68%	58%	72%	67%	59%	71%

	Progress		Interim standard			Alternative 1			Alternative 2			Alternative 3		
Sample	benchmark	*N*	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe	Acc	Sen	Spe
FARMS-eligible students	PSY1F credits ≥ 12	33,491	63%	36%	90%	65%	41%	88%	70%	70%	71%	70%	71%	70%
	PSY1F credits ≥ 15	33,491	72%	42%	87%	73%	49%	84%	68%	76%	64%	68%	78%	63%
	PSY1S credits ≥ 24	22,987	64%	38%	89%	66%	44%	86%	71%	73%	68%	70%	74%	67%
	PSY1S credits ≥ 30	22,987	74%	47%	85%	74%	54%	82%	67%	82%	61%	66%	83%	59%
	PSY1F GPA ≥ 2.0	32,970	49%	29%	88%	51%	33%	85%	65%	61%	72%	65%	62%	70%
	PSY1F GPA ≥ 2.5	32,970	58%	32%	87%	59%	36%	84%	66%	65%	68%	66%	66%	66%
	PSY1F GPA ≥ 3.0	32,970	65%	35%	84%	65%	39%	81%	65%	68%	62%	64%	69%	61%
	PSY1S GPA ≥ 2.0	22,903	45%	29%	88%	47%	34%	85%	64%	61%	73%	65%	63%	71%
	PSY1S GPA ≥ 2.5	22,903	55%	32%	87%	57%	38%	84%	68%	67%	69%	68%	68%	67%
	PSY1S GPA ≥ 3.0	22,903	66%	37%	84%	66%	43%	81%	66%	73%	62%	66%	74%	60%

Note. Acc = accuracy rate; FARMS = free and reduced-price meal services; GPA = grade point average; PSY1F = postsecondary first-year fall term; PSY1S = postsecondary first-year spring term; Sen = sensitivity rate; Spe = specificity rate. Lighter versus darker color shading in the exhibit distinguishes between lower versus higher percentages.

Exhibit T.17. Sensitivity and Specificity Rates for Alternative CCR Standards With Different Thresholds for PSAT and HSGPA



Note. The exhibit presents the sensitivity and specificity rates for different PSAT (top graph) and HSGPA (bottom graph) thresholds for the CCR standard. CCR = college and career readiness; HSGPA = high school grade point average; PSY1F = postsecondary first-year fall term.

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