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Access to Advanced Placement: Unequal Opportunity, Untapped Potential

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Access to Advanced Placement:

Unequal Opportunity, Untapped Potential

A dissertation submitted in partial satisfaction of the

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in Education

by

Anita Ka-man Cassity

2013

ABSTRACT OF THE DISSERTATION

Access to Advanced Placement:

Unequal Opportunity, Untapped Potential

by

Anita Ka-man Cassity

Doctor of Education in Education

University of California, Los Angeles

Professor Tyrone C. Howard, Co-chair

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Research has found that many high school students (particularly Black and Hispanic ones) with the academic potential to succeed in Advanced Placement courses are not taking them, with implications not only for their own college prospects but also for their teachers, schools and communities. Through descriptive and logistic analyses of College Board data on over two million students in the Class of 2012, this study mapped the heretofore unknown national contours this problem, identifying patterns by state, subject, school AP enrollment policy, and student characteristics.

It found that state- and subject-level rates of fulfilling AP potential varied widely, ranging from 42%-81% by state and 2%-41% by subject. Some states and subjects demonstrated rough parity across ethnic groups while others demonstrated large gaps, both positive and negative.

Asian students with high potential to succeed in AP Math and Science engaged in those AP courses at almost double the rates of their equally qualified Black, White and Hispanic peers. Nationally, two-thirds of students with unfulfilled AP potential attended a school that offered at least one AP course for which they had high potential. This proportion varied by state, subject and race/ethnicity.

This study found an even starker problem at the point of preparation for AP. Only 10% and 14% of Black and Hispanic students who took the PSAT/NMSQT demonstrated high AP potential, compared to almost half of their Asian and White peers. Overall, Black and Hispanic students were underrepresented among students who demonstrated and fulfilled high AP potential.

Schools that used nationally standardized PSAT/NMSQT scores to identify students for AP had a higher average proportion of students fulfilling AP potential compared to schools that used exclusively local academic criteria and/or student and parent input. This positive relationship between using PSAT/NMSQT and higher fulfilled AP potential was driven primarily by the effects for White students. Using PSAT/NMSQT had inconsistent or negative effects on the rate at which schools' fulfilled Black, Hispanic or Asian students' AP potential.

Finally, this study found that after controlling for race/ethnicity, being male, being an English learner, and having a lower GPA significantly decreased a student's likelihood of fulfilling high AP potential. Meanwhile, higher father's education and higher postsecondary degree goal aspirations tended to increase a students' likelihood of fulfilling AP potential. Mother's education had mixed effects, depending on ethnicity.

The dissertation of Anita Ka-man Cassity is approved.

Todd M. Franke

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University of California, Los Angeles

2013

DEDICATION

For Quinzale and Michael, Joshua and Jude

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VITA

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CHAPTER ONE: STATEMENT OF THE PROBLEM

Each year, hundreds of thousands of American high school students miss the opportunity to participate in Advanced Placement (AP) despite having strong academic potential to succeed in these formative – and high-stakes – college-level courses. By one analysis, nearly 771,000 students who graduated in 2011 demonstrated the potential to succeed in one or more AP exams. Less than 38% actually took one (College Board, 2012a). By another estimate, the U.S. has the capacity of quintupling the number of students passing the AP calculus exam alone (Wainer, 2011). African-American and Hispanic students with high academic potential are disproportionately less likely than their Asian and White counterparts to be enrolled in AP classes. Of students who graduated in 2011, only 20% of Black and 30% of Hispanic students took an AP exam for which they had potential, compared to 38% and 58% of their White and Asian peers, respectively (College Board, 2012a).

Why does this "AP Potential gap"—the difference between the number of students with potential to succeed in AP and the number who actually participate— matter? For individual students and their parents, it matters for college admission, cost and success. AP or other advanced courses are often a de-facto admission requirement to selective universities, with many universities giving added weight to students who take AP courses or receive a passing score on an AP exam (Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009). Colleges may grant students college credit for AP coursework, which can lower the total costs of college as well as students' time to degree completion (College Board, 2011a). And strong AP exam scores can also qualify students for scholarships and financial aid (Iatarola, Conger, & Long, 2011).

For educators, it matters because we, as a profession, strive to help every child achieve his or her potential. That we may be failing large numbers of our students in this regard

challenges us to understand where we are expecting too little and adopt new practices so that every child has the opportunity to fulfill her potential.

For schools, the AP Potential gap matters because, increasingly, AP participation and performance rates influence both a school's perceived reputation in the community, as well as its evaluation according to state accountability frameworks (see e.g., Florida Department of Education, 2011; Texas Education Agency, 2011). Two national rankings of high schools, the U.S. News and World Report rankings and Jay Mathews' *Challenge List*, also base their calculations either in part or whole on schools' AP exam scores.

And for our nation, the AP Potential gap matters as both an economic and a social issue. Ensuring that our students engage in learning opportunities that spark and advance their intellect is crucial in nurturing the talent that will innovate, refine and drive the economy and civil society of the future. The fact that we are disproportionately failing to maximize the potential of our highest-achieving African-American and Hispanic students with such opportunities is an injustice that harms not only those students but our country as a whole.

Unfortunately, we know virtually nothing about this problem – other than that it exists. Beyond the aggregate figures cited at the beginning of this paper, no other research on this problem has been published. And while these national statistics are helpful for exposing the national issue, they are not actionable. They do not illuminate whether disparities in AP access for qualified Black and Hispanic students are concentrated in particular subject areas or are an issue across all subjects; whether disparities are greater in some states and whether others have effectively closed the gaps; or whether disparities are due primarily to schools' not offering AP courses or also an issue in schools that *do* offer AP. They do not help state, district or school

policymakers understand what the problem looks like in their schools or what actions they might take to address it.

This study helps fill this knowledge gap by picking up where the previously available research left off: painting a state-by-state, subject-by-subject big picture sketch that enables us to begin to understand where the AP potential gaps are largest, where they are smallest, which states are doing better and which are doing worse. In addition, it explores how schools' most fundamental AP policies – whether to offer an AP course and what data is used to determine AP enrollment – relates to the AP potential gaps. Finally, it begins to sketch out how academically qualified Black/Hispanic students who ultimately took an AP course differed from their equally qualified, Black/Hispanic peers who did not. This quantitative analysis lays the foundation for understanding and pinpointing exactly where, for whom, to what extent, and in what subjects the "AP Potential gap" is a problem. It also yields a series of questions that lend themselves to future, more qualitative research into the reasons for the gaps and potential solutions for closing them.

Background: Access to Advanced Placement

Since its inception in the 1950s, the Advanced Placement program - owned and administered by the College Board and comprised of approximately 30 college-level courses designed for students while in high school – has expanded exponentially, from 1,229 students taking 2,199 exams in 1956 to nearly two million students taking 3.5 million exams in over 18,000 schools in 2011 (College Board, 2011b). These figures illustrate the dramatic democratization of the AP program over the last half-century, from a small program available to just handful of elite high students to one that gives millions of students each year the opportunity to accelerate their education and engage in college-level coursework.

While AP access has expanded overall, it has not expanded equally for all. Research has consistently found that Black, Latino and low-income students are significantly underrepresented in the ranks of AP students. Nationally, while African-American students made up 14.6% of the Class of 2010, they made up only 3.9% of the successful AP examinee population in that class (defined as those students who scored a three or higher on at least one AP exam). Similarly, Hispanic students made up 16.8% of the Class of 2010 nationally but only 14.6% of the successful AP examinees (College Board, 2011c).

These disparities have been consistently replicated in state-, district- and school-level analyses over the past 15 years. For instance, Solorzano and Ornelas (2002), examining data from a large California district, found that in 1995-96, Hispanic students were 68% of the overall high school student enrollment, but only 45% of AP enrollment. Similarly, African Americans comprised 13% of the district's student enrollment but only 4% of the AP population. Drilling down to the school-level, they found that schools serving urban, low-income Hispanic and African-American communities enrolled the fewest number of students in AP classes while schools in more racially mixed, suburban and wealthier areas enrolled more students in AP. Even when Hispanic students attended high schools with large numbers of students taking AP courses, they were not equally represented in AP enrollment, a pattern which Solorzano and Ornelas named "Schools within Schools."

In a follow-up study, Solorzano and Ornelas (2004) examined statewide 2000-01 data from the California Department of Education as well as data from the Los Angeles Unified School District (the state's largest district and the second largest in the country). Affirming their 2002 study, they found again that Hispanic and African-American students were underrepresented in the state's Top 50 AP high schools, that schools serving urban, low-income

Hispanic and African-American communities had low AP enrollment, and that the "schools within schools" phenomenon continued. These disparities in access to AP courses have also been replicated in analyses of statewide data from Texas (Klopfenstein, 2004a, 2004b) and Florida (Conger, Long, & Iatarola, 2009). National College Board data from 2010 demonstrates the extent of these disparities by state, finding that African-American students were disproportionately underrepresented amongst successful AP students in 48 states and the District of Columbia, while Hispanic students were underrepresented in 36 states (College Board, 2011c).

Explaining Disparities in AP Access and Success: General Findings

A handful of studies have attempted to identify why Black and Hispanic students have had disproportionately less access to AP and other advanced courses than their White or Asian peers. These studies have taken primarily microeconomic approaches to this question, applying statistical analyses and regressions to large state (primarily Florida and Texas) or older national data sets (such as the National Education Longitudinal Study 1988) to identify variables that predict AP enrollment or course offerings.

The findings suggest that *pre-high school achievement* is one of the most important factors explaining the disparities in advanced course enrollment for African-American and Hispanic students (Conger et al., 2009; Iatarola et al., 2011; Kelly, 2009; Klopfenstein, 2004a). *Poverty* is a closely related second factor, with wealthier students more likely to take AP than their less advantaged peers, and African-American and Hispanic students more likely to experience poverty than White students. These findings are likely an outgrowth of the well-documented achievement gap facing Black and Hispanic students, the reality that minority and low-income students attend lower-resourced schools where they have fewer opportunities to

learn (Burciaga, Huber, & Solorzano, 2009; Oakes, 2004), and the fact that student placement into high-level, honors classes or "tracks" is closely related to both prior achievement and socioeconomic status (Gamoran, 1992).

Further underscoring the critical relationship between pre-high school achievement and AP availability, Iatarola, Conger and Long (2011) determined that having a critical mass of students with very high 8th grade achievement scores was the greatest predictor of whether a school offered AP courses. In other words, pre-high school achievement influences AP access in two ways: 1) an individual student's chances of getting in an AP class and 2) whether his or her school even offers AP courses to get into in the first place.

While the literature is clear that race, poverty and prior achievement are often closely related, disentangling their specific relationships to one another has been more difficult. Conger, Long and Iatarola (2009), in their analysis of Florida data, found that disparities for minority students disappeared after controlling for poverty and prior achievement and that in fact Black, Latino and Asian students were *more* likely than similar White students to enroll in advanced high school courses. Their finding contrasts with earlier research conducted in the Midwest finding that unequal access to honors coursework remained for minorities, even after controlling for prior achievement and even in districts that self-reported efforts to consciously ensure equal access (Gamoran, 1992). It is unclear whether these different findings are due to differences in the sample populations or changes over time.

Research has also found that AP participation is related to *school size*. Large schools tend to offer the most AP courses (Iatarola et al., 2011; Klopfenstein, 2004a), while schools that are small and rural are less likely to offer AP courses (Klopfenstein, 2004b). However, more AP courses did not automatically translate into higher AP enrollment rates or lower disparities in

AP participation between African-American and Hispanic students and their White peers. One study found that AP enrollment rates were actually lower in larger schools (Klopfenstein, 2004a), while another study found that disparities in AP access for African-American or Hispanic students persisted even in schools with greater AP availability (Solorzano & Ornelas, 2004).

Beyond student population characteristics and size, access to AP is influenced by two key school AP policies: 1) whether to offer AP courses; and 2) how to identify and enroll students in AP courses.

A school's decision regarding whether and which AP courses to offer is obviously a fundamental factor influencing student access to AP. By default, students in schools that do not offer AP courses have much greater difficulty accessing AP than students in schools that offer AP. Some of these schools may offer alternative advanced study options such as dual enrollment in a local community college or the IB program, but many do not.

Once a school decides to offer an AP program, it must then establish policies regarding how and which students to enroll. No single entity governs school AP enrollment policies nationally. As a result, AP enrollment policies vary significantly from school to school, from curricular tracking to open enrollment to "gatekeeping" criteria such as straight A's, high teacher recommendations, and evidence of strong motivation and study habits (Attewell, 2001; Mathews, 1999; National Research Council, 2002). This variation in policy is magnified by the fact that criteria such as grades and teacher recommendations are both local and subjective, and thus difficult to compare or interpret consistently across classrooms, much less schools. While several studies have explored what percentage of schools report using various AP enrollment

policies and criteria, none have systematically examined the relationship between these policies and Black and Hispanic student access to AP.

AP Disparities for High-Potential Students: An Unexplored and Unexplained Problem

The existing body of literature examines AP access gaps *in general*, without differentiating by academic achievement. As a result, until now, researchers have coalesced around three primary explanations as to why Black and Hispanic students are generally underrepresented in AP and other advanced courses, as outlined by Conger et al. (2009):

1. "Pre-high school" disparity – Black and Hispanic students are less prepared than other students for AP because of the quality of the education they receive in elementary and middle school, a result perhaps of inferior resources, low expectations and early tracking into low-level courses
2. "Offering" disparity – Black and Hispanic students attend high schools where advanced courses are simply not offered
3. "Across-school access" disparity - Black and Hispanic students attend high schools with characteristics that lower their likelihood of enrolling in advanced courses even when they are offered. For example, they may disproportionately attend large, under-resourced schools where school staff cannot provide personalized advising and encouragement to enroll in advanced courses

However, these explanations are problematized by the fact that *high-potential* Black and Hispanic students are also disproportionately failing to gain access to AP. Black and Hispanic students aren't accessing AP just because they are less prepared, or because they attend schools that don't offer AP. They are failing to gain access even when they *are* prepared and there *are* AP courses at their schools. Clearly, there are other factors at play.

We have known little about what these other factors might be. The extant research on AP access has not explored patterns in disparities specifically for high-potential Black and Hispanic students, much less possible explanations for what is causing these inequities or how they can be overcome. We have not known whether these disparities are concentrated in particular subject areas or are an issue across all subjects. We have not known if the disparities are greater in California than in Kentucky, or if they are of similar magnitude in all states. We have not known how these disparities relate to schools' AP policies: to what extent these non-participating, high-potential Black and Hispanic students attend schools that simply do not offer AP courses, to what extent these disparities relate to the type of criteria schools use to identify and enroll students in AP courses, and whether schools that use more standardized indicators of a students' AP potential, such as the PSAT/NMSQT, have smaller disparities than those that do not. We have not even known basic information about how high AP potential Black and Hispanic students who ultimately do participate in AP differ from their high AP potential Black and Hispanic peers who do not.

This study begins to fill that knowledge gap. Through a quantitative analysis of the College Board data on the Class of 2012 (a longitudinal, matched cohort data set that includes over two million students who graduated in 2012 and matches their AP potential with their actual AP participation), this study maps the heretofore unknown national contours of the problem of unfulfilled AP potential, identifying patterns by state, subject, school AP enrollment policy, and student characteristics. Four questions guided the analysis:

1. What proportion of Black, Hispanic, White and Asian students with high AP potential are taking an AP exam, by state and subject?

2. Of the Black, Hispanic, White and Asian students who do not take an AP exam for which they have high potential, what proportion (nationally, by state and by subject) attend schools that do not offer the course?
3. After taking into account what the literature indicates are relevant predictors of AP access, what is the influence of school AP enrollment policy on the percent of students fulfilling AP potential?
4. Within racial/ethnic groups, how do students with high AP potential who take AP exams differ from students with potential who do not?

Since the goal was to sketch out the nuances of the problem across all states and subjects, I used PSAT/NMSQT scores as the measure of student AP potential. As discussed further in Chapter Two, PSAT/NMSQT scores have been found to correlate strongly with success in particular AP scores, more so than high school GPA or number of prior courses taken in a subject. Moreover, unlike GPA or course-taking, which is subject to local variation and definition, PSAT/NMSQT scores are a standardized measure of potential that can be applied and compared across schools.

By mapping the national contours of the AP potential gaps, this study begins to pinpoint exactly where, for whom, to what extent, and in what subjects the "AP Potential gap" is a problem. It reveals which states and schools are successfully closing the gap (and which are not), thus yielding potential targets for deeper examination and fulfilling a necessary prerequisite for more qualitative studies into the reasons for the gaps and potential solutions for closing them. And it identifies a preliminary set of school- and student-level factors that relate to the fulfillment of AP potential. In total, this study provides insight that can inform current practice while also laying a foundation for future research into why so many high-potential students are

not engaging in advanced placement courses and what specific policies, practices and structures can perpetuate or disrupt inequities in access to AP.

CHAPTER TWO: REVIEW OF THE LITERATURE

As discussed in the previous chapter, hundreds of thousands of American high school students are not participating in advanced coursework despite having strong academic potential to do so (College Board, 2012a). High-achieving Black and Hispanic students are significantly more likely to not take an AP exam than similarly prepared Asian and White peers, even when they attend schools that offer the AP course for which they have potential. While several studies have examined disparities in AP access in *general*, virtually none have investigated the persistent lack of access for students who have already demonstrated academic potential. The current study helps to fill this gap in the literature.

To frame the analysis, this literature review synthesizes available research in four key areas. First, I briefly review the background and history of the AP program to provide a basic understanding of what it is and how it operates. Second, I examine the literature regarding the benefits and uses of advanced high school coursework in order to set the conceptual framework for why the "AP Potential gap"[1] matters. Third, I discuss how schools determine student enrollment in an AP course and the research base for the validity of these AP placement methods. This section includes a review of the validity of PSAT/NMSQT scores (the measure used in the current study to identify AP potential) as predictors of AP success. Finally, I review the literature related to general disparities in access to advanced coursework and why these disparities exist. This general AP access literature frames the larger context for the current study, providing variables that were used to build the exploratory model of what predicts the fulfilling of AP potential that this study tested.

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[1] In this study, I define "AP Potential gap" as the difference between the number of students who have demonstrated the potential to succeed in AP courses (as measured by PSAT/NMSQT scores) and the number who actually take an AP exam.

Background on the Advanced Placement Program

The Advanced Placement (AP) program, owned and administered by the non-profit organization the College Board, is one of several options for students to engage in advanced study and earn college-level credit while still in high school. First established in 1950 as a Ford Foundation-funded pilot project, it provides students with the opportunity to take college-level courses in their high schools, taught by trained high school teachers. Other advanced study options include the *International Baccalaureate* program, which is also high-school based but available in only about 750 high schools in the United States as of March 2012 (International Baccalaureate Organization, 2012), and *dual or concurrent college enrollment*, where high school students take college-level courses at two- or four-year colleges, with college students and professors.

The AP Program currently offers 34 courses in the humanities, sciences, social sciences, mathematics, arts and world languages. Teachers must develop and submit a syllabus through an audit process in order to have their courses designated as "AP," but otherwise have wide latitude and flexibility in how they choose to present and pace the course content for their students. A committee of college faculty and high school teachers develops each course and corresponding end-of-course AP exam, as well as convenes annually in June to grade the free-response section of the exams. Each exam includes both a multiple-choice section and free-response section, with the exception of the Studio Art courses, which are entirely based on portfolio assessments (College Board, 2012b). Exams are graded on a scale of one to five, with grades of three or higher considered to be "passing." The College Board determines grade designations by administering AP exams to actual college students, and asserts that a score of three is equivalent to a "C", four equivalent to a "B" and five equivalent to an "A" (Camara, Dorans, Morgan, &

Myford, 2000). Students may take an AP course without taking the culminating AP exam, or vice versa, but colleges typically award credit or advanced placement only to students who receive a grade of three or higher on an AP exam.

From its beginning as a pilot project between about a dozen colleges and seven high schools, AP has grown to one of the largest national programs of advanced study in the United States. In 2011, nearly two million students in over 18,000 schools took almost 3.5 million AP exams (College Board, 2011b). This participation represents roughly 12% of the total U.S. high school population of 16 million students and 43% of the approximately 42,000 public and private schools with secondary grades (Snyder & Dillow, 2011). A collaborative community of educators from across the K-12 and higher education spectrum develops, delivers and utilizes the AP program. In 2011, this community included almost 130,000 U.S. public high school teachers who taught an AP course, nearly 6,000 college faculty who reviewed AP teachers' syllabi, developed curricula or scored AP exams, and over 3,000 U.S. colleges and universities that received AP scores for credit, placement and/or admissions (College Board, 2012a).

Uses and Benefits of AP

AP and College Access: Placement, Credit and Admissions

In its original conception, Advanced Placement, as indicated by its name, was designed as a means of advanced college placement. It allowed students to demonstrate mastery of introductory subject knowledge while in high school, avoid unnecessary repetition in introductory college courses and place directly into intermediate or advanced courses in the related discipline. Many colleges continue to grant course credit or advanced placement for AP today, though specific policies vary by institution. Numerous colleges grant credit and/or

placement for AP exam scores of three or higher, while others do so only for scores of four or five and only for selected subjects (College Board, 2011a; Lichten, 2000; Sadler & Tai, 2007).

AP's credit and placement benefits can open up a number of options for students with qualifying exam scores. Students may earn credit that can shorten the time to degree attainment (e.g., graduating in three years rather than four), which can help save both time and money.[2] AP may also allow students to use their limited time in college to advance further in their chosen field of study, with some institutions giving students the opportunity of achieving a combined baccalaureate and master's degrees in four years (see e.g., President & Fellows of Harvard College, 2009). And some institutions allow students to use AP to place out of core requirements, so that they can explore other areas of greater interest to them. This last benefit, while potentially appealing to students, has its critics among college faculty who express concern that students who, for example, never take another college math course because AP Calculus allowed them to satisfy the core math requirement, miss out on the latest research and excitement in a discipline that might have otherwise sparked an intellectual interest (National Research Council, 2002).

Beyond placement and credit, many colleges also use AP in admissions. Some states and institutions give automatic extra weight to AP courses in calculating a student's grade point average (GPA), for example, through the addition of an extra point on the traditional GPA four-

[2] Research has yielded mixed results regarding the extent to which AP students take advantage of the shortened time to degree benefits. Several studies have found that AP students graduate in significantly less time than students who did not take AP exams (Morgan & Klaric, 2007; Willingham & Morris, 1986). A study of a large cohort of Texas students found that students who earned a three or higher on at least one AP exam were more likely to graduate from college in five years or less compared to non-AP students (Dougherty, Mellor, & Jian, 2006). Another study of University of California students found that while AP units were related to reduced time to degree, the relationship was weak and many students did not use their AP units to shorten their time to graduation (Eykamp, 2006). A single institution study from the University of Tennessee at Mason found that after controlling for preentry attributes, there were no significant differences in five-year graduate rates between regular, AP or dual enrollment students. Collectively, the research indicates that while AP students on average have shorter time to graduation, there is significant variation among individual students and institutions.

point scale. This extra weight directly boosts a student's grade point average, indirectly increases a student's class rank, and significantly advantages an AP student in the admissions process, particularly at institutions like the University of California that rely on GPA-based formulas to filter qualified students from very large applicant pools (Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; National Research Council, 2002). Students in schools that do not offer AP courses are at an automatic disadvantage in these types of admissions processes. Several class action lawsuits have sought to remedy this inequity by suing for equal access to AP across high schools, with only limited success (Solorzano & Ornelas, 2004).

Colleges that take more holistic approaches to admissions through the reading of individual applications and consideration of more subjective factors also factor in AP, though in a less mathematical manner. In general, these schools look for students who take advantage of the opportunities available to them, evaluating students' academic record against their schools' available academic programs. Students who attend schools that offer AP courses are thus often judged in part on whether they enrolled in AP, with those who did not enroll being at a disadvantage in the admissions process. This is particularly true of admissions to highly selective universities who expect applicants to take the most challenging curriculum available, and relatively less important for less selective or non-selective institutions (National Research Council, 2002). If a student attends a school that does not offer AP, admissions officers report that the lack of AP availability does not typically disadvantage a student's admission prospects, so long as the student takes the most demanding courses available and performs well. Some admissions deans, however, report that limited advanced coursework offerings may indirectly impact students because their schools may be perceived as having less rigorous academic programs (National Research Council, 2002). Since researchers have found that a rigorous high

school curriculum, which includes AP, is the strongest predictor of bachelor degree completion (Adelman, 1999, 2006), colleges are less likely to "dip deeper" into the lower class ranks in academically weaker schools than in schools perceived to have stronger academic programs (National Research Council, 2002).

In total, 3,239 U.S. colleges and universities received AP scores for credit, placement and/or admissions in 2011 (College Board, 2012a), representing roughly 75% of our country's approximately 4,400 degree-granting two- and four-year postsecondary institutions (Snyder & Dillow, 2011). Given its pervasive role in admissions, credit and placement, AP clearly matters for students and parents when it comes to college access. This relationship between AP and college access is affirmed by research that indicates AP participants have higher college enrollment than non-AP students (Chajewski, Mattern, & Shaw, 2011; Flowers, 2008; Wyatt & Mattern, 2011).

AP and College Success: Grades, Persistence and Graduation

The literature is more mixed when it comes to AP's precise relationship to college success, typically defined in the literature in terms of grades, persistence, or ultimate degree attainment and graduation.

Studies consistently find that AP students have higher second-year retention rates and GPAs (Brody, Assouline, & Stanley, 1990; Duffy, 2010; Eimers & Mullen, 2003; Klopfenstein & Thomas, 2009; Mattern, Shaw, & Xiong, 2009; Wyatt & Mattern, 2011), as well as higher graduation rates (Hargrove, Godin, & Dodd, 2008). However, it is not yet clear whether this relationship between AP participation and college success is a causal one. In general, AP students tend to be higher achieving, more motivated and in better resourced schools than non-

AP students. It is unclear how much of the AP effect is due to these other student and school characteristics versus how much is due to a value-added effect of the AP program itself.

To isolate the AP value-add, recent studies have begun to employ a range of statistical controls for prior academic achievement, student ability, student characteristics, school-level characteristics and non-AP coursework. Applying such controls, at least two studies have found that merely taking an AP course does not reliably predict college performance (Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009). It matters *how well* a student does in the AP course. Studies have generally found that students who score a three or higher on AP exams tend to have higher college performance outcomes compared to non-AP students and AP students who fail or do not take the AP exam, even after controlling for background characteristics (Geiser & Santelices, 2004; Hargrove et al., 2008; Keng & Dodd, 2008; Mattern et al., 2009; Morgan & Klaric, 2007; Sadler & Sonnert, 2010; Scott, Tolson, & Yi-Hsuan Lee, 2010)

AP and High School Accountability and Rankings

Beyond college access and success, AP participation and performance have increasingly begun to play a role in state high school accountability and rankings. For instance, Florida assigns A-F grades to high schools, with 300 of the total 1600 point rubric based on participation and performance in accelerated coursework, which can include AP, IB, dual enrollment or other defined acceleration options (Florida Department of Education, 2011). Texas also incorporates AP participation and performance into its high school accountability system (Texas Education Agency, 2011). A number of additional states including Indiana, Idaho, Georgia, New Mexico, Oklahoma, and Nevada, either currently or will soon incorporate AP into their high school accountability frameworks, based on this author's review of states' recently submitted requests for waivers to the Elementary and Secondary Education Act (U.S. Department of Education,

n.d.). Two national rankings of high schools, the U.S. News and World Report rankings and Jay Mathews' *High School Challenge Index*, also base their calculations at least in part on schools' AP exam scores (Mathews, 2012; U.S. News & World Report, 2012).

AP and Science, Technology, Engineering and Math (STEM)

Building America's scientific and technological human capital has frequently been cited as a key component to strengthening our nation's economy and increasing America's international competitiveness (National Academy of Sciences, 2007). Preliminary research suggests that students who take an AP science or mathematics exam are more likely to major in the sciences (Morgan & Maneckshana, 2000; Shaw & Barbuti, 2010; Tai, Liu, Almarode, & Fan, 2010) and select a STEM career (Robinson, 2003) than non-AP students. While this relationship has not been established as causal, it does suggest the importance of better understanding AP potential gaps in the AP science and math fields and its possible implications for building our nation's future STEM talent.

***

In sum, as participation in AP has expanded over the last half-century, so too has its uses. Taking and, more importantly, *succeeding* in AP courses, particularly as demonstrated by passing the culminating AP exam, has significant implications for college access, college success, high school accountability and possibly future STEM capacity. Given the significance of succeeding in AP, how can we identify students with the potential to do so? What are the predictors of AP success?

Identifying AP Potential: Predictors of AP Success

Surprisingly, limited published research exists to answer these questions. Conceptually, the educational community agrees that, given the challenging and often fast-paced nature of AP

courses, AP success requires that students be *prepared* for the rigors of the course and *motivated* to put in the additional time and effort it will demand. But what are valid indicators of student preparation and motivation?

Schools frequently answer this question through local measures such as prior grades, prior coursework and teacher recommendations (Milewski & Gillie, 2002; National Research Council, 2002). While high school GPA correlates with AP exam scores (Sadler & Sonnert, 2010), researchers have not yet rigorously explored the predictive validity of teacher recommendations. We also do not know whether these measures sufficiently identify *all* students with the potential to succeed in advanced study. They likely underestimate the number of students with AP potential, given early curricular tracking that limits lower-tracked students' opportunities to gain and demonstrate prerequisite academic knowledge (National Research Council, 2002). Moreover, variation in course quality and grading policies across schools, coupled with grade inflation and individual subjectivity in teacher assessments, undermine the ability to establish a single national GPA cut score, prerequisite course of study, or level of teacher recommendation.

To supplement these local means of identifying students and identify a possible national barometer of AP potential, the College Board conducted two large-scale national studies examining the relationship between Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT/NMSQT) scores and eventual performance on AP exams. The PSAT/NMSQT is a program cosponsored by the College Board and National Merit Scholarship Corporation, and is a nationally administered, standardized test that measures critical reading, math problem-solving and writing skills.

In the first study, Camara and Millsap (1998) examined all sophomores and juniors who took the PSAT/NMSQT in October 1993 and October 1994, and identified whether they completed one or more AP exams in 1993-94 or 1994-95. They then matched these students against the College Board's SAT database to obtain additional information on students' self-reported high school grades and courses completed. (The College Board asks students who register for the SAT to complete a detailed "Student Data Questionnaire" (SDQ) where they provide, among other information, their background, courses, grades, and college plans.) Of the more than 3.5 million sophomores and juniors who took the PSAT/NMSQT in 1993 or 1994, 704,919 (approximately 20%) also took one or more AP exams in 1993-94 or 1994-95. Of these 704,919 students, 501,649 (71%) completed the SAT's SDQ prior to September 1995, and thus had data on grades and prior course history.

Camara and Millsap (1998) found a strong and consistent relationship between PSAT/NMSQT scores and AP exam grades for 25 of the 29 AP examinations at the time. Correlations were greater than 0.50 for 17 examinations. Sample sizes for each exam ranged from 1,588 in French Literature to 190,512 in U.S. History. Using the SAT SDQ data, Camara and Millsap then examined the correlation of high school grades and number of courses completed in a subject with AP examination grades. They found that PSAT/NMSQT scores had consistently higher correlations than high school grades and courses completed. For example, the PSAT/NMSQT had an average correlation of .518 with the respective AP Examinations; the next best predictor was total high school grades with a mean correlation of 0.267 for the same 25 AP Examinations. The number of high school courses in related subjects was the least correlated with AP exam grades, with most correlations below 0.10.

Ewing, Camara and Millsap conducted a 2006 follow-up study after significant increases in both the PSAT/NMSQT and AP examinee populations as well as the addition of several new AP exams. In addition to examining the correlations between PSAT/NMSQT scores and AP exam grades, they also analyzed students' self-reported cumulative high school grade point average (HSGPA) and self-reported grades in related courses. To assess the usefulness of PSAT/NMSQT scores in predicting AP exam grades over and above more traditional academic indicators, they also examined the incremental validity of PSAT/NMSQT scores as compared to HSGPA and related course grades. Finally, they assessed the extent to which the PSAT/NMSQT and AP relationship varied as a result of student gender, ethnicity and grade-level (sophomore or junior) (Ewing, Camara, & Millsap, 2006).

Similar to the original study, they found that PSAT/NMSQT scores were moderately to strongly related to AP exam grades in 29 of the 33 AP exams then available (the exceptions were German Language, Spanish Language, Studio Art: Drawing and Studio Art: 2-D Design). All correlations were above 0.4, with the strength of the relationship varying by AP subject. PSAT/NMSQT scores were most strongly correlated with AP English Language and AP Literature and least strongly correlated with AP Spanish Literature. Also replicating the findings of the original study, the researchers found that PSAT/NMSQT scores more strongly correlated to AP exam grades (average correlation = 0.56) than either cumulative HSGPA (average correlation = 0.28) or related courses grades (average correlation = 0.25).

In examining the incremental validity of PSAT/NMSQT scores for 11 of the most commonly-taken AP exams (Biology, Calculus AB, Calculus BC, Chemistry, English Language, English Literature, U.S. Government and Politics, Macroeconomics, Psychology, Statistics and U.S. History), Ewing, Camara and Millsap found that adding PSAT/NMSQT to cumulative

HSGPA and relevant course grades explained more of the variability in AP exam grades than just grades alone. Cumulative HSGPA and related course grades accounted for just 5.2-17% of variability in AP grades, depending on the subject. Adding PSAT/NMSQT scores increased the explanatory power of the model to 24-54%, depending on the subject. When disaggregating by ethnicity and gender, the researchers found that PSAT/NMSQT scores were as strong or even stronger predictors of AP exam grades for African-American, Hispanic and Asian students than for White students, and for female students over male students. However, the differences were not large, indicating that the relationship between PSAT/NMSQT scores and AP exam grades was generally consistent across ethnicity and gender.

To test the purported relationship between the PSAT scores and AP performance, Wainer (2011) examined the actual AP participation and passing rates of three communities and found that the AP results aligned with what PSAT data would have been predicted. Although a small study, it provides at least some external validation for the College Board's research regarding the predictive potential of PSAT results. He concludes, "Through the use of cheap but reliable aptitude tests like the PSAT, jewels can be discovered that might otherwise be missed. And once such promise is uncovered, some students previously thought to be unqualified can be given an opportunity and perform successfully" (Wainer, 2011, p. 54).

One final important finding is that despite the strong relationship between PSAT and AP, schools should not use PSAT scores as a *sole* measure for placing students into AP classes, nor should they establish minimum PSAT "cut scores" (Camara & Millsap, 1998). While PSAT scores were strongly to moderately related to AP performance, statistical analysis showed that PSAT and previous course grades together still accounted for only 24-54% of variability in AP exam grades (Ewing et al., 2006). This indicates that there are a number of other factors,

including student motivation, interest and persistence and teacher practice, which could influence AP success. Ewing et al. also found that "a significant group of students have a less-than-break-even chance of succeeding on many AP Examinations today, but many of these students can and will succeed in AP courses because of factors that cannot be measured by tests, grades, or past performance" (Ewing et al., 2006, p. 26). In other words, PSAT scores can be used as a barometer by which to identify students for AP, but they should not be used as a gatekeeper.

Disparities in Access to Advanced Placement

The PSAT's potential to uncover "hidden jewels" who may have been overlooked by teachers, counselors or even themselves is important because AP access has not expanded equally for all students. For years, African-American, Hispanic and low-income students have been and continue to be significantly underrepresented in the ranks of AP students. Nationally, while African-American students made up 14.7% of the graduating class of 2011, they made up only 4.1% of the successful AP examinee population in that class (defined as those students who scored a three or higher on at least one AP exam). Similarly, Hispanic students made up 17.6% of the class of 2011 nationally but only 15.2% of the successful AP examinees (College Board, 2012a).

These disparities have been replicated in state-, district- and school-level analyses over the past 15 years. For instance, Solorzano and Ornelas (2002), examining data from a large California district, found that in 1995-96, Hispanic students were 68% of the overall high school student enrollment, but only 45% of AP enrollment. African Americans comprised 13% of the district's student enrollment but only 4% of the AP population. At the school-level, they found that schools serving urban, low-income Hispanic and African-American communities enrolled the fewest number of students in AP classes while schools in more racially mixed, suburban and

wealthier areas enrolled more students in AP. Yet even when Hispanic students attended high schools with large numbers of students taking AP courses, they were not equally represented in AP enrollment, a pattern which Solorzano and Ornelas dubbed "Schools within Schools."

In a follow-up study, Solorzano and Ornelas (2004) examined statewide 2000-01 data from the California Department of Education as well as data from the Los Angeles Unified School District, the state's largest district and the second largest in the country. Affirming their 2002 findings, they found again that Hispanic and African-American students were underrepresented in the state's Top 50 AP high schools, that schools serving urban, low-income Hispanic and African-American communities had low AP enrollment, and that the "schools within schools" phenomenon continued. These disparities in access to AP courses have also been replicated in analyses of statewide data from Texas (Klopfenstein, 2004a, 2004b) and Florida (Conger et al., 2009). Across the country, African-American students are disproportionately underrepresented amongst successful AP students in all 50 states and the District of Columbia, while Hispanic students were underrepresented in 41 states (College Board, 2012a).

Explaining Disparities in AP Access and Success

A handful of studies have attempted to identify why Black and Hispanic students have had disproportionately less access to AP and other advanced courses than their White or Asian peers. These studies have taken primarily microeconomic approaches to this question, applying statistical analyses and regressions to large state (primarily Florida and Texas) or nearly 20-year-old national data sets (such as the National Education Longitudinal Study 1988) to identify variables that predict AP enrollment or course offerings.

The findings suggest that *pre-high school achievement* is one of the most important factors explaining the disparities in advanced course enrollment for African-American and Hispanic students (Conger et al., 2009; Iatarola et al., 2011; Kelly, 2009; Klopfenstein, 2004a). *Poverty* is a closely related second factor, with wealthier students more likely to take AP than their less advantaged peers, and African-American and Hispanic students more likely to experience poverty than White students. These findings are likely an outgrowth of the well-documented achievement gap facing Black and Hispanic students, the reality that minority and low-income students attend lower-resourced schools where they have lower opportunities to learn (Burciaga et al., 2009; Oakes, 2004), and the fact that student placement into high-level, honors classes or "tracks" is closely related to both prior achievement and socioeconomic status (Gamoran, 1992).

Further underscoring the critical relationship between pre-high school achievement and AP availability, Iatarola, Conger and Long (2011) determined that having a critical mass of students with very high 8th grade achievement scores was the greatest predictor of whether a school offered AP courses. In other words, pre-high school achievement influences AP access in two ways: 1) an individual student's chances of getting in an AP class and 2) whether his or her school even offers AP courses to get into in the first place.

While the literature is clear that race, poverty and prior achievement are often closely related, disentangling their specific relationships to one another has been more difficult. Conger, Long and Iatarola (2009), in their analysis of Florida data, found that disparities for minority students disappeared after controlling for poverty and prior achievement and that in fact Black, Latino and Asian students were *more* likely than similar White students to enroll in advanced high school courses. Their finding contrasts with earlier research conducted in the Midwest

finding that unequal access to honors coursework remained for minorities, even after controlling for prior achievement and even in districts that self-reported efforts to consciously ensure equal access (Gamoran, 1992). It is unclear whether these different findings are due to differences in the sample populations or changes over time.

Research has also found that AP participation is related to *school size.* Large schools tend to offer the most AP courses (Iatarola et al., 2011; Klopfenstein, 2004a), while schools that are small and rural are less likely to offer AP courses (Klopfenstein, 2004b). However, AP enrollment rates were lower in larger schools in a study analyzing statewide data from Texas (Klopfenstein, 2004a), nor does increased AP course availability equate to equal AP access for African-American or Hispanic students (Solorzano & Ornelas, 2004).

Beyond student population characteristics and size, *school policies* play a significant role in determining equal (or unequal) opportunities to engage in AP coursework. Access to AP is influenced by two key school decisions: 1) whether to offer AP courses; and 2) how to identify and enroll students in AP courses. By default, students in schools that do not offer AP courses have much greater difficulty accessing AP than students in schools that offer AP. Some of these schools may offer alternative advanced study options such as dual enrollment in a local community college or the IB program, but many may not.

Schools that do offer AP courses employ a number of methods for determining, and often limiting, student access to AP. As briefly discussed earlier, one common practice is curricular tracking, where only a top tier of students enroll in advanced courses while other students take a less rigorous and often less prestigious curriculum (Attewell, 2001; Mathews, 1999). This tracking extends into America's most competitive and well-resourced high schools, where even high-achieving students are not able to take AP courses due to school policies that limit AP

enrollment to only the best students. As a result, high-achieving students in some elite schools are actually less likely than similarly achieving students in less prestigious schools to take AP and honors courses (Attewell, 2001).

School prerequisites also influence access to AP. One study that reviewed over 100 high school curriculum guides (less than 1% of schools that offer AP courses) found that AP and International Baccalaureate (another advanced coursework program) enrollment requirements ranged from open admission to PSAT scores, straight A's in prior courses, high teacher recommendations and evidence of strong motivation and study habits (National Research Council, 2002). A second survey of a national sample of over 30,000 AP teachers from 23 AP subject areas from November 1999 to February 2001 also found that schools set a range of criteria, with prior student success and course-taking being the most common prerequisites. Of the respondents, 58.8% required faculty recommendations, 53.3% required a combination of prerequisite courses and 49% required certain grades achieved in prior courses. A third indicated that their schools offered open enrollment. Only 8% utilized test scores such as PSAT/NMSQT (Milewski & Gillie, 2002). While a 2008 survey of a nationally representative sample of AP teachers reports reductions in restrictive "gatekeeping" policies (Farkas & Duffett, 2009), no research has yet been conducted to verify this trend or its impact upon Black and Hispanic access to AP.

Conclusion

In sum, while access to AP has increased significantly over the last two decades, it has not expanded equally for all. African-American and Hispanic students are disproportionately underrepresented in the ranks of successful AP students, due in part to pre-high school disparities in academic learning opportunities and achievement. Even when African-American and

Hispanic *are* prepared, they are still less likely to take the AP course for which they have demonstrated potential (College Board, 2012a).

While no research has yet explored the reasons for this latter problem (the focus of this current study), the general AP disparities literature suggests a few possible explanations. Perhaps students with unfulfilled AP potential are primarily in high-poverty schools that are simply not offering AP courses. Perhaps they are in small or rural schools that do not have the ability to allocate limited resources for AP courses. Perhaps they are from lower-income families that are not aware of the value of AP and thus are not even searching for AP opportunities. Perhaps they are disproportionately missing out on AP STEM courses that require previous coursework (such as AP Calculus or Chemistry) unavailable to them due to tracking.

Or perhaps they are attending one of the many schools that limit AP enrollment using criteria that may not be comprehensive predictors of student success. Most schools continue to use tracking, teacher recommendations and prior grades to identify AP students. Very few schools use PSAT scores, the one measure for which at least some large-scale validity data exists, even though some research suggests that PSAT scores are better predictors of AP success than either grades or courses completed (Camara & Millsap, 1998). This is the case even though the College Board has developed a free online "AP Potential" tool for schools that identifies students' potential to succeed in AP courses, by subject and based on the research regarding the PSAT-AP relationship.

Collectively, the literature on AP's uses and benefits indicates that AP participation, especially *successful* AP participation as evidenced by a three or higher on an AP exam, matters. It matters for students and parents when it comes to college access and success. It matters for educators and schools in terms of accountability, perceived quality, and the various benefits or

sanctions that accompany a positive or negative evaluation. It may also matter for our nation's future scientific innovation and economic competitiveness. However, hundreds of thousands of students with the potential to succeed in AP courses are not engaging in these advanced courses. This study will help to address this problem by painting a big picture sketch of exactly where, for whom, to what extent, and in what subjects this "AP Potential gap" is a problem. This will serve as a first, necessary step for better diagnosing the nuances of the issue, while also generating a series of questions that will guide and inform future research and action.

CHAPTER THREE: RESEARCH DESIGN, METHODS, AND MEASURES

Research Questions

As reviewed in the previous chapter, emerging research has found that many high school students with the academic potential to succeed in Advanced Placement courses are not taking them, with implications not only for their own college prospects but also for their teachers, schools and communities. High-achieving Black and Hispanic students appear to be affected by this lack of access much more so than their Asian and White peers. Unfortunately, we know little about this problem. The existing research on AP access does not explore patterns in disparities specifically for academically prepared Black and Hispanic students, much less possible explanations for what is causing these inequities or how they can be overcome.

To begin to fill this knowledge gap, the current study paints a big picture sketch of the problem by exploring four research questions:

1. What proportion of Black, Hispanic, White and Asian students with high AP potential are taking an AP exam, by state and subject?
2. Of the Black, Hispanic, White and Asian students who do not take an AP exam for which they have high potential, what proportion (nationally, by state and by subject) attend schools that do not offer the course?
3. After taking into account what the literature indicates are relevant predictors of AP access, what is the influence of school AP enrollment policy on the percent of students in a school fulfilling high AP potential?
4. Within racial/ethnic groups, how do students with high AP potential who take AP exams differ from students with potential who do not?

Research Design

To explore these questions, I conducted a quantitative, secondary data analysis of College Board data on the Class of 2012, a longitudinal, matched cohort data set that includes over two million students who graduated in 2012 and matches their AP potential with their actual AP participation. PSAT/NMSQT scores were utilized as the measure of AP potential. As discussed in Chapter 2, PSAT/NMSQT scores have been found to correlate with success in particular AP scores, more so than high school GPA or number of prior courses taken in a subject. In addition, unlike GPA or course-taking, which is subject to local variation and definition, PSAT/NMSQT scores are a standardized measure of academic preparation that can be applied and compared across schools. This quantitative design allowed me to map the national contours of the identified problem and examine whether certain patterns emerged by state, subject, AP enrollment policy, or student-level characteristics.

Definitions

For the purposes of this analysis, key terms are hereafter defined as follows:

AP potential: Predicted likelihood of scoring a three or higher on a given AP exam, based on research and expectancy tables developed by the College Board which link PSAT/NMSQT scores with predicted AP performance (Ewing et al., 2006). AP potential likelihoods are subject-specific, range from 0% to 90% in intervals of 10%, and are available for 23 AP subjects. PSAT-based AP potential data is not available for AP foreign language and studio art exams.

High AP potential: Students who had 70% or greater likelihood of scoring a three or higher on a given AP subject exam, based on PSAT/NMSQT scores. I utilized the 70% threshold because 1) that was a threshold used by previous studies that reported national aggregate data (College Board, 2011c), thus allowing some comparability, and 2) because it

represents a relatively strong likelihood of succeeding in AP. Students may demonstrate high AP potential in 1-23 subjects, depending on their PSAT/NMSQT scores. For example, a student may have a 70% likelihood of scoring a three or higher on AP Calculus AB, but only a 30% likelihood of scoring a three or higher on AP English Literature.

Fulfilled AP potential: Students who had 70% or higher likelihood of scoring a three or higher in at least one AP subject and took at least one AP exam.[3]

Unfulfilled AP potential: Students who had 70% or higher likelihood of scoring a three or higher in at least one AP subject and did not take any AP exams.

Methods and Measures

Study Sample and Site

The study sample consisted of all students who graduated from high school in 2012 and took the PSAT/NMSQT at some point during high school. Because one of the goals of the study was to explore the role of school policies, the sample was restricted to students who were associated with a school in the 50 states and the District of Columbia (D.C.) (n = 2,213,526 students and n = 22,742 school codes) and excluded home-schooled students and students with missing school information. To explore the situation comprehensively across all students in the U.S., the sample included students in both public and private schools (previous research has examined only students in public schools).

I chose this sample of students because, as discussed above, studies have shown the PSAT to be a strong predictor of students' potential to succeed in an AP course, more so than high school GPA or prior course-taking. This sample thus has standardized, longitudinal data

[3] For consistency, since AP potential data was only available for 23 subjects, the AP test-taking data and analysis was restricted to the same 23 exams.

regarding "AP potential" that is comparable across diverse schools. The group is large enough (over two million students in over 22,000 high schools in all 50 states and D.C.) to have some generalizability across the larger population of U.S. high school students, albeit with some constraints. Finally, having just graduated from high school, this sample of students is also recent enough to provide insight regarding the current nature of the problem.

I analyzed data from all sites that were included in the sample, both private and public, because the purpose of the study was to map the national contours of the identified problem and discover possible patterns that emerge by state, subject, AP school policies, and student-characteristics. For the same reasons, all students in the sample were included in the analyses, rather than a sub-sample. Analyzing a smaller sample would not have yielded the same power as analyzing the full group. It might also have introduced unidentified biases if the sub-sample were to differ in systematic ways from the full dataset.

Description of the Data Sets

The complete dataset for my study was constructed from data files maintained by the College Board. These data files originated from five sources:

1. **College Board student-level matched PSAT, AP and AP Potential test file for the Class of 2012,** which included students' PSAT test scores, grade in which they took the PSAT, expected likelihood of scoring a 3 or higher on each of 23 AP exams (ranging from 0% and 90%, in intervals of 10%), complete AP testing history including AP exam scores, year in which they received the AP score, whether they utilized an AP fee reduction, school, state, and basic demographic characteristics such as gender and ethnicity.

2. **College Board school-level AP coordinator survey data from 2010-11 and 2011-12,** which provided schools' self-reported practices for identifying students for AP courses. The College Board annually issues this survey to high schools in its database, in order to collect data on school AP practices as well as obtain a preliminary number of students who are enrolled in AP courses to plan for the exam administration. While the College Board states that a response is required, not all schools consistently respond each year. The 2011-12 survey data included responses from 13,648 schools; the 2010-11 data included responses from 13,339 schools.
3. **College Board school-level AP Audit data for 2010-2011 and 2011-12,** which included which AP courses a school had been approved to offer. Teachers must annually submit their course syllabi in order to have their courses approved as AP. This data was used as the proxy for whether a school offered an AP course in a given year.
4. **School-level demographic data from 2010-11 from the National Center for Education Statistics' (NCES) Common Core of Data (CCD)**, which included school enrollment by grade and race/ethnicity, number of students participating in the free- and/or reduced lunch program (as a proxy for number of low-income students) and locale type (rural, town, urban or suburban). CCD is a program of the U.S. Department of Education that annually collects data on all public schools and districts in the United States through state education agencies. The College Board annually imports and matches the latest CCD data tables into its own database. At the time of the analysis, NCES had not yet published the 2011-12 data.

5. **College Board student-level SAT Questionnaire data for the Class of 2012,** which included self-reported student data on measures such as cumulative GPA, parental education, primary language, and college interests. Students report these data when they register for the SAT.

Data were provided by the College Board, with terms of usage governed through a data license agreement co-signed by myself and the College Board. Because of the sensitivity and privacy regulations related to student-level data, all student-identifying information was removed from the datasets prior to transmission to me. Each student was identified only by a unique, randomly-assigned numeric identifier that was different from the actual identifier used in the College Board's day-to-day operations. Similarly, each school was only identified by a unique school identifier, city and state. School name and street address were not included in the dataset that was provided to me.

Merging Data and Final Datasets

The College Board provided the data in tab-delimited, text format, which I imported into SPSS for merging and analysis. The College Board employs unique school identifiers that are utilized in all data files, which allowed me to merge and match data across the five data sources. The development and merging of the final datasets occurred through the following steps:

1. The master student-level test file was restricted to students who had AP potential data and were affiliated with a school in the 50 states and D.C. (This dataset was used for Research Question #1).
2. The master student-level test file from Step 1 was further restricted to students who had high AP potential in at least one subject, then merged with the AP Audit course offering data. (This dataset was used for Research Question #2).

3. The master student-level test file from Step 1 was aggregated by school. The new school-level file was then merged with the AP Audit course offering data, the AP Coordinator Survey enrollment policy data, and the NCES demographic data. (This dataset was used for Research Question #3).
4. The student-level test file from Step 2 was merged with the variables of interest from the SAT student questionnaire data. (This dataset was used for Research Question #4).

Not all schools associated with students in the College Board's master student-level data file had corresponding NCES or AP coordinator's survey data, which could have been due to a number of reasons. For instance, private schools are not captured in NCES data and not all schools return the AP survey each year. Schools for which demographic and/or AP policy data were missing were omitted from the school-level analysis examining the influence of school AP enrollment policy. Similarly, not all students in the master file took the SAT. Since the data on student GPA, parental education, primary language and postsecondary degree aspirations pulled from student responses to the SAT Data Questionnaire, students who did not take the SAT were omitted from this phase of the analysis due to missing data. Appendix A outlines the sub-samples of students included in each component of the analysis, as well as the match rates in the final merged datasets.

Measures

Measures ranged from state to student-level, depending on the research question. Table 1 summarizes the outcome measures and independent variables for each phase of the study.

Table 1

Outcome Measures and Independent Variables, by Research Question

Research Question	Level of Analysis	Outcome Measure (Type)	Independent Variables
1. What proportion of Black, Hispanic, White and Asian students with AP potential are taking an AP exam, by state and subject?	State Subject	% of students (in a state or subject) with high AP potential who took at least one AP exam (Scale: 0-100%)	n/a
2. Of the Black, Hispanic, White and Asian students who do not take an AP exam for which they have potential, what proportion (nationally, by state and by subject) attend schools that do not offer the course?	State Subject	% of students (in a state or subject) with unfulfilled AP potential who attended a school that offered at least one AP course for which they had high potential (Scale: 0-100%)	n/a
3. After taking into account what the literature indicates are relevant predictors of AP access, what is the influence of school AP enrollment policy on the percent of students fulfilling AP potential?	School	% of students (in a school) with high AP potential who took at least one AP exam (Scale: 0-100%)	School-level correlates: • Number of students with high AP Potential in the school • Number of AP courses offered in school • Grade 9-12 enrollment • % of Grade 9-12 enrollment who was low-income • % of Gr 9-12 enrollment who was minority • Locale type (rural, town, surburban, urban) School-level variable of interest: • School AP enrollment policy (used grades and/or teacher recommendation only; used student/parent input but not PSAT; used PSAT)
4. Within racial/ethnic groups, how do students with high AP potential who take AP exams differ from students with potential who do not?	Student	Whether student took at least one AP exam (Dichotomous: 1 = took AP; 0 = did not take AP)	Student-level characteristics • Gender • Cumulative GPA • Highest father's education • Highest mother's education • Primary language • Postsecondary degree goal

School Measures. School measures included number of students with high AP Potential in the school (aggregated and calculated from the student-level data), number of AP courses offered in school (calculated using AP Audit data), school high school enrollment, percent of high school enrollment who was low-income (using Free and/or Reduced Lunch participation as a proxy), percentage of high school enrollment who was minority, and locale type (rural, town, urban or suburban). These factors, which the literature has indicated are relevant predictors of AP access, served as correlates for exploring Research Question #3 (*After taking into account what the literature indicates are relevant predictors of AP access, what is the influence of school AP enrollment policy on the percent of students fulfilling AP potential*).

The variable of interest for this question was AP school enrollment policy. The original AP coordinator survey that was used as the source for this variable allowed respondents to choose any of eight different options: GPA; grade in a required prerequisite course; recommendation from teacher of prerequisite course; AP teacher's discretion; parental support or involvement; student desire; PSAT/NMSQT scores; and other. Because respondents could select any and all factors that applied, there were dozens of combinations of factors. For this analysis, data were re-coded into three categories: 1) schools that used only grades and/or teacher recommendation; 2) schools that used student/parent input but not PSAT scores; and 3) schools that used PSAT scores with or without other factors. This allowed me to explore, at a macro level, whether there were differences in the fulfillment of AP potential between schools that used only local academic measures to enroll students in AP; schools that used a nationally standardized measure of AP potential; and schools that allowed for parental and student input but did not use a standardized measure of academic potential.

Student Measures. For Research Question #4 (*Within racial/ethnic groups, how do*

students with high AP potential who take AP exams differ from students with potential who do not ?), measures for each student included gender, cumulative GPA, highest level of mother's and father's education, best language spoken, and postsecondary degree aspirations. To facilitate data analysis, mother and father's highest education and postsecondary degree goal were re-coded from categorical to numeric variables based on average number of years associated with the level of education achieved. Table 2 lists the student variables and values.

Table 2

List and Values of Student Variables

Variable	Original Values	Recoded Valued
AP Potential Fulfilled	1 = AP potential fulfilled 0 = AP potential unfulfilled	
Gender	Male Female	n/a
Cumulative GPA	Interval variable from 0.00 (Fail) to 4.30 (A+)	n/a
Best language spoken	English only English and another language Another language	n/a
Mother and father's highest education	No response Grade School Some high school High school diploma Trade school Some college Associate's degree Bachelor's degree Some graduate Graduate degree	Missing 6 10 12 13 13 14 16 16.5 18
Postsecondary degree aspiration	No response Certificate Associate's degree Bachelor's degree Master's degree Doctoral degree Other Undecided	Missing 13 14 16 18 20 12 12

Data Analysis Methods

To explore Research Questions #1 and #2, I employed descriptive statistical methods in SPSS to identify the rates at which students were demonstrating high AP potential and fulfilling AP potential across states and AP subjects. Using the AP potential variables (originally a scale variable from 0 to 90) and AP test-taking variables, I calculated a new "AP potential status" categorical variable with four categories:

1) Did not have high AP potential in any subject
2) Had high AP potential in at least one subject and took no AP exams (unfulfilled AP potential)
3) Had high AP potential in at least one subject and took at least one AP exam for which he/she had high potential (fulfilled AP potential – recommended exam)
4) Had high AP potential in at least one subject, did not take any exams for which he/she had potential but did take at least one exam for which he/she did *not* have high potential (fulfilled AP potential – non-recommended exam)

I used crosstabs to aggregate the number of students who demonstrated and fulfilled high AP potential by race/ethnicity, state and subject. Crosstabs were also used to identify how many students with unfulfilled AP potential attended schools that offered at least one of the subjects for which they had potential. The resulting output was then transformed to yield proportions.

Multinomial logistic regression was used to examine Research Question #3 (the effect of school AP enrollment policy on the percent of students fulfilling AP potential.)[4] Schools were clustered into six ordinal categories based on the proportion of their students fulfilling AP

[4] Scatterplots of the dependent variable (percentage of school's students who fulfilled AP potential) against the independent variables indicated that the data violated the linearity requirement of OLS regression, rendering multiple linear regression an inappropriate method of analysis.

potential. Because there were a considerable number of schools with either 0% or 100% of students fulfilling AP potential, these cases were set apart as separate categories in order to examine relationships that might be unique to these cases.

- Category 1: 0%
- Category 2: >0% up to 25%
- Category 3: >25 % up to 50%
- Category 4: >50% up to 75%
- Category 5: >75% and <100%
- Category 6: 100%

Multinomial logistic regression was run with each category as a reference group, in order to assess the effects of the independent variables between and across all categories. The model was run five times, first for all students, then for Black, Hispanic, White and Asian students.

Finally, to explore Research Question #4 regarding the differences between students of the same race/ethnicity who fulfilled high AP potential and those who did not, I used binary multiple logistic regression because the outcome variable was dichotomous (whether or not a student took an AP exam for which he/she demonstrated academic potential). The data were filtered by race/ethnicity and logistic regressions run separately for Black, Hispanic, White and Asian students.

CHAPTER FOUR: FINDINGS

To better understand where students are not fulfilling their AP potential and who those students are, this study developed a state-by-state, subject-by-subject accounting of the gaps across the United States. It analyzed how schools' most fundamental AP policies – whether to offer an AP course and what data is used to determine AP enrollment – relate to the AP potential gaps. Finally, it examined how academically qualified students who took an AP course differed from their equally qualified peers who did not.

Analytic findings are presented below in four sections, aligned to the four guiding research questions:

1. Proportion of students who are fulfilling high AP potential
2. Proportion of students with high AP potential who attended schools that offered AP
3. Effect of AP enrollment policy on schools' rate of AP Potential fulfilled
4. Student-level differences between students who demonstrated high AP potential and took at least one AP exam vs. students who demonstrated high AP potential but did not take any AP exams

Proportion of Students who are Fulfilling High AP Potential

National results

Nationally, of the 2.2 million students in the class of 2012 who took the PSAT/NMSQT and had corresponding AP potential data, 32% (710,530 students) demonstrated high AP potential in at least one subject. As shown in Figure 1 below, different racial/ethnic groups demonstrated different rates of high AP potential, with just 10% of Black students and 14% of Hispanic students demonstrating high potential, compared to 50% of Asian students and 44% of White students.

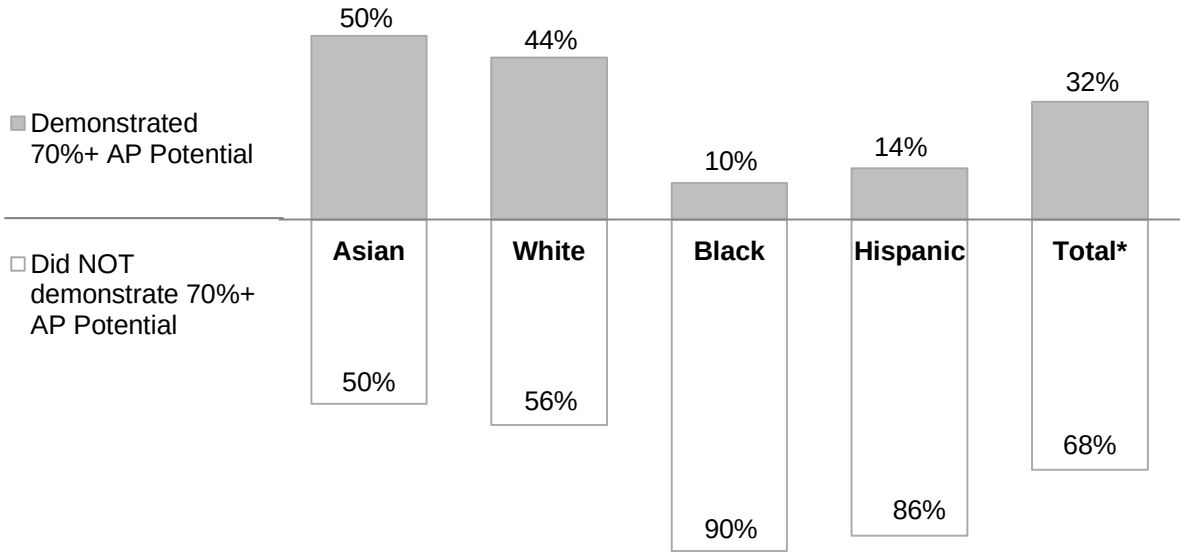

Figure 1. Proportion of students demonstrating high AP potential in at least one subject, by race/ethnicity.

Note. "Total" includes all students, including students who are American Indian/Native, Other, and who did not self-report their race/ethnicity. Total n = 2,213,526; White n = 1,144,725; Asian n = 158,100; Black n = 334,596; Hispanic n = 420,821.

Of the 710,530 students who demonstrated high AP potential in at least one subject, 70% took an AP exam: 57% for a subject for which they had predicted potential (a "recommended" exam) and 13% for a subject for which they did not have predicted potential (a "non-recommended" exam). Asian students with high AP potential had the highest rates of taking AP (84%), while Black students with high AP potential had the lowest rates (67%). See Figure 2. Black and Hispanic students with high AP potential had slightly higher rates of taking non-recommended AP exams compared to their White and Asian peers.

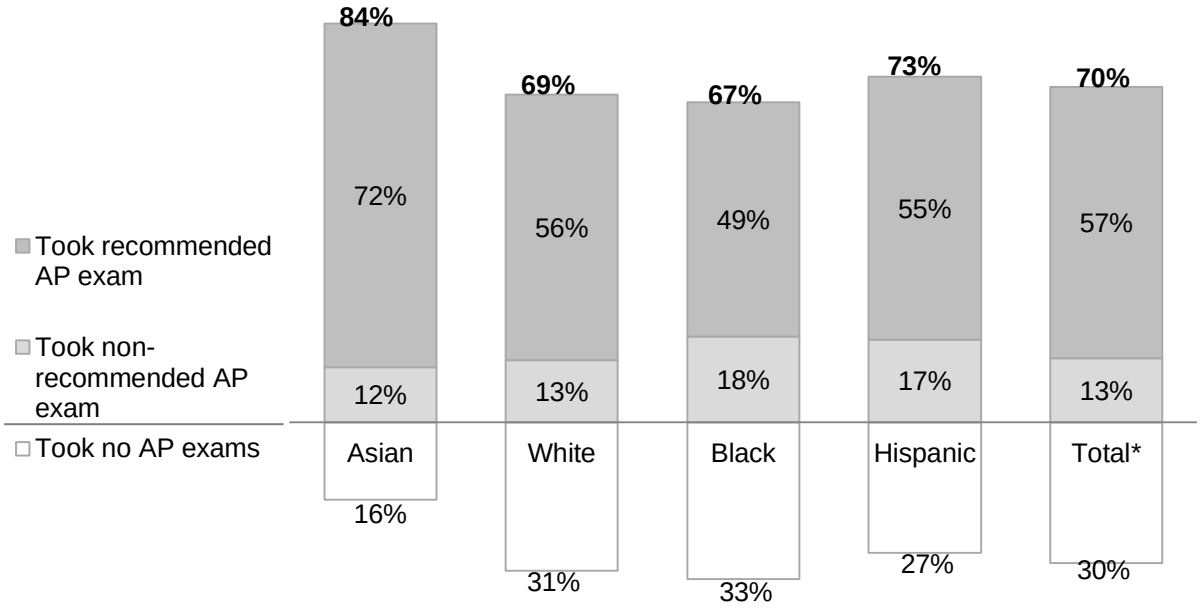

Figure 2. Proportion of students fulfilling high AP potential, by race/ethnicity.

Note. "Total" includes all students, including students who are American Indian/Native, Other, and who did not self-report their race/ethnicity. Total n = 710,530; White n = 506,930; Asian n = 79,087; Black n = 33,170; Hispanic n = 59,660.

Figure 3 compares the racial/ethnic make-up of the overall PSAT/NMSQT population (which roughly matches the overall U.S. child population), the subpopulation that demonstrated high AP potential, and the sub-subpopulation that fulfilled AP potential. Overall, Black and Hispanic students were under-represented among students who demonstrated and fulfilled high AP potential. While Black and Hispanic students collectively make up 34% of the total population of students taking the PSAT/NMSQT, they comprised only 13% of students who demonstrated and fulfilled high AP potential.

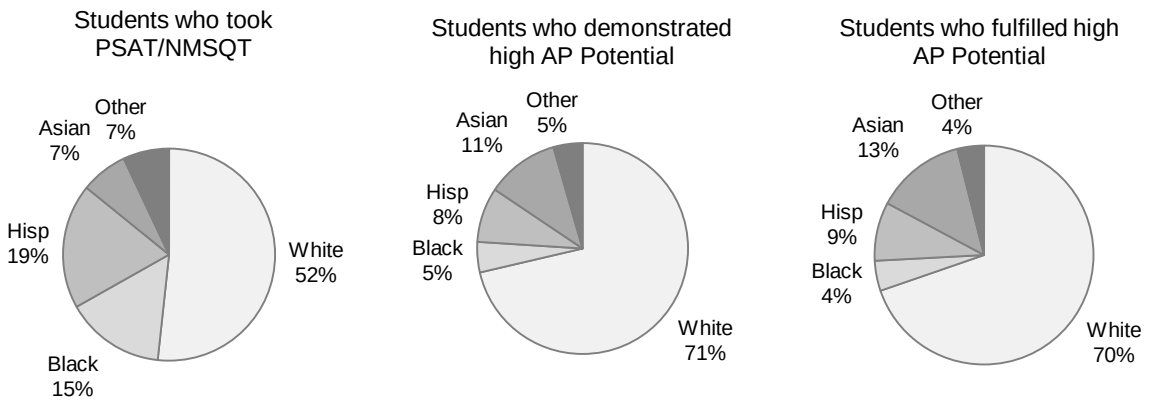

Figure 3. Comparison of racial/ethnic make-up of students who took PSAT, demonstrated high AP Potential, and fulfilled AP Potential.

By State

While, nationally, 70% of students with high AP potential took at least one AP exam, the state-by-state data varied widely, ranging from a low of 42% of students fulfilling high AP potential in North Dakota to a high of 81% in Arkansas, Florida and Washington, DC. Seventeen states and DC had higher percentages of students with high potential taking AP than the national average. Geographically, rural states like Idaho, Kansas, Nebraska and North Dakota had some of the lowest rates of fulfilled AP potential and states with large urban centers like Florida, Maryland and California had some of the highest. That said, there were a number of exceptions to this pattern, such as Arkansas (which had one of the highest rates of students fulfilling AP potential) and Oregon (who had one of the lowest – though outside of Portland, one could argue that Oregon is a predominantly rural state). The mid-Atlantic had the highest median rate of fulfilling AP potential, the West had the lowest median, and the Midwest was

home to the states with the absolute lowest rates of fulfilling AP potential. [5] However, as Figure 4 below shows, there was significant variation within regions in the rates at which states were fulfilling AP potential. Figure 5 presents the state-by-state rates of students fulfilling AP potential, from highest to lowest.

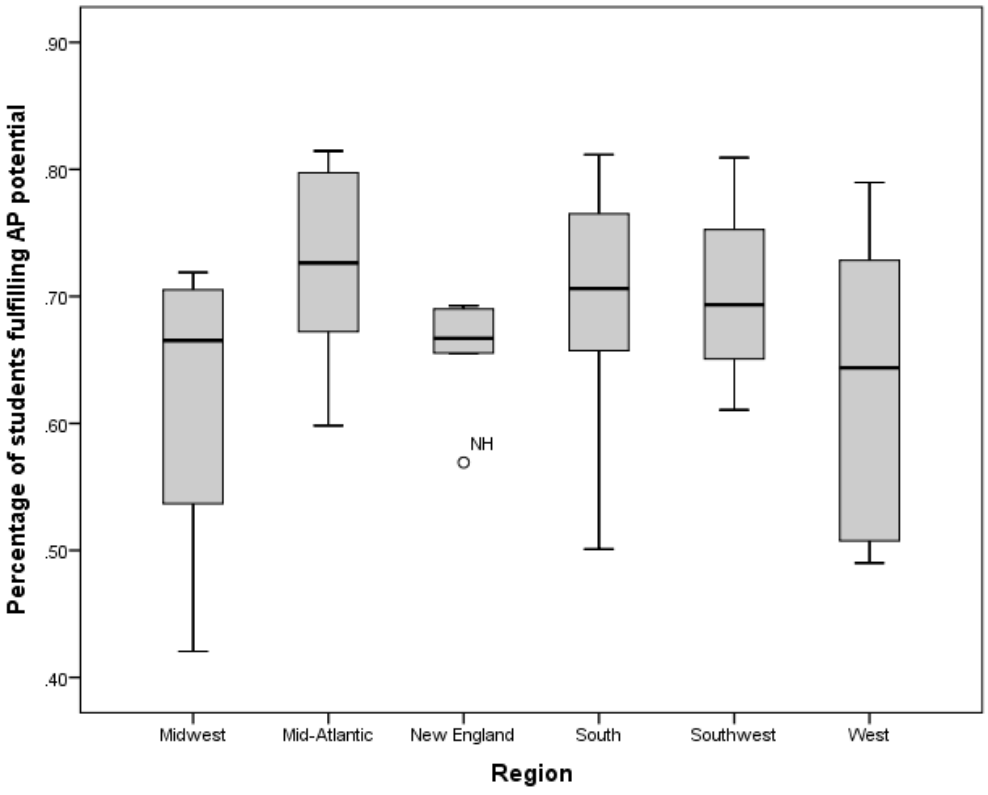

Figure 4. Boxplot of state-level percentages of students fulfilling AP potential, by region.

[5] Because the College Board often works with states on a regional basis, regions were defined using the College Board's regional structure in order to support use of this data by College Board member institutions and staff. The Midwest includes North Dakota, South Dakota, Nebraska, Kansas, Missouri, Iowa, Minnesota, Wisconsin, Illinois, Indiana, Michigan Ohio, and West Virginia. The Mid-Atlantic includes New York, Pennsylvania, New Jersey, Delaware, DC, and Maryland. New England includes New Hampshire, Massachusetts, Vermont, Rhode Island, Maine, and Connecticut. The South includes Virginia, Georgia, Louisiana, Alabama, Mississippi, South Carolina, North Carolina, Tennessee, Florida and Kentucky. The Southwest includes Texas, Arkansas, Oklahoma and New Mexico. The West includes Washington, California, Oregon, Idaho, Nevada, Montana, Wyoming, Utah, Colorado, Arizona, Alaska and Hawaii.

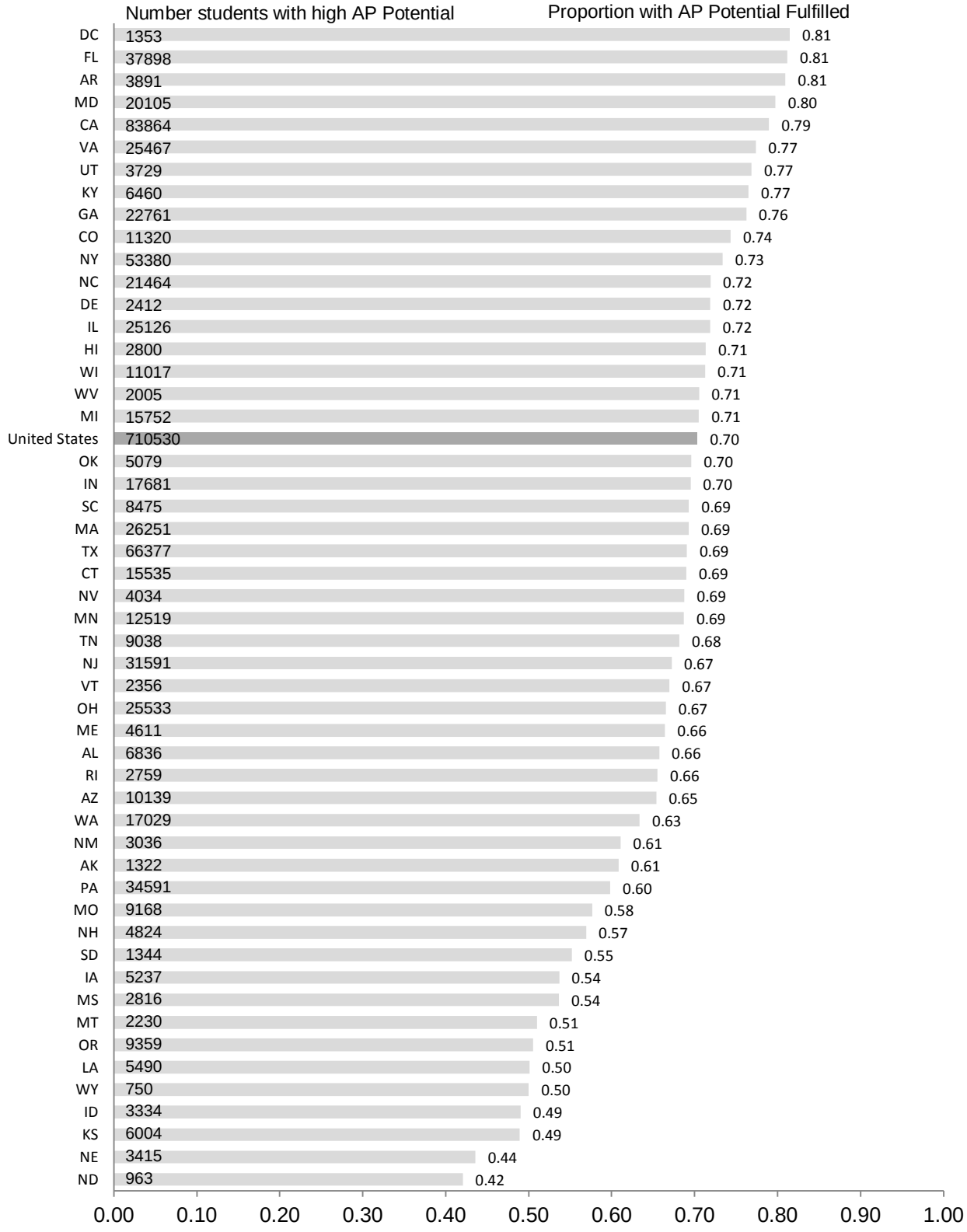

Figure 5. Proportion of students with high AP potential who took at least one AP exam, all students, by state.

Disaggregating the rates of AP potential fulfilled by race/ethnicity revealed greater range and variance in the rates at which Black and Hispanic students with high AP potential took AP, compared to their White and Asian peers. (See Table 3). For example, none of the four Black students in North Dakota who demonstrated high AP potential took any AP, while 89% of the 171 Black students in Arkansas took at least 1 AP exam. Similarly, only 20% (one) of the five Hispanic students in North Dakota who had high AP potential took an AP exam, while 86% of Hispanic students with high AP potential in Arkansas took at least one AP exam.

Table 3

Proportion of students, by state, who demonstrated high AP potential and took AP: Summary descriptive statistics

	Min	Max	Range	*M*	*SD*	*Var*
All Students	.42	.81	.39	.66	.10	.010
Asian	.51	.89	.38	.70	.08	.006
Black	.00	.89	.89	.60	.14	.020
Hispanic	.20	.86	.66	.66	.11	.013
White	.42	.83	.41	.65	.10	.011

n = 51 (50 states plus DC)

States with similar numbers of students with high AP potential often had quite different rates of fulfilling that potential. For example, while both Arkansas and Wisconsin had about 170 Black students with high AP potential, 89% of the Arkansas students took AP compared to just 57% of the Wisconsin students. Similarly, while Michigan and Oregon had around 400 Hispanic students demonstrate high AP potential, only 51% of the students in Oregon took AP compared to 71% in Michigan. Figure 17 to Figure 20 in Appendix B present the state-by-state detail of

AP potential fulfilled rates, disaggregated for Asian, Black, White and Hispanic students.

The in-state differences in the rates at which various racial/ethnic groups fulfilled AP potential also varied widely by state, with some states demonstrating rough parity across ethnic groups and others demonstrating large gaps, both positive and negative. States that demonstrated higher parity included Florida (where the rate at which Black, Asian, White and Hispanic students fulfilled AP potential fell between 80-88%) and the District of Columbia (where between 79-86% of Black, Asian, White and Hispanic students with AP potential took at least one AP exam). Vermont, New Hampshire and North Dakota fell at the opposite end of the spectrum, where the largest differences between racial/ethnic groups were 34, 37 and 85 points, respectively. See Table 10 and Table 11 in Appendix B for state-by-state rates of fulfilled AP potential, disaggregated by ethnicity.

Focusing specifically on the difference in the rates at which Black and White students with high AP potential took AP, this Black-White gap ranged from -42 pts in North Dakota (where 0% of Black students with high AP potential took AP, compared to 42% of Whites) to +19 pts in Nebraska (where 60% of Black students fulfilled their high AP potential, compared to 42% of White students). The Hispanic-White difference ranged from -26 pts in Vermont (where 42% of Hispanic students fulfilled AP potential compared to 67% of White students) to +20 pts in Mississippi (where 73% and 52% of Hispanic and White students fulfilled AP potential, respectively). On average, across states, the mean Black-White difference in fulfilled AP potential was -5 points, compared to 0 points between Hispanic and White students.

By Subject

Examining the data at the subject-level also revealed considerable variation in the rate of AP Potential fulfilled across subjects, from 2% in Music Theory to 41% in U.S. History. The top

five subjects with the highest proportions of students fulfilling AP potential were U.S. History (41%), Calculus AB (41%), English Literature (39%), English Language (34%), and U.S. Government (27%), while the subjects with the least students fulfilling AP potential included the less commonly offered Music Theory, Art History, Comparative Government and Computer Science. Figure 6 illustrates the proportion of students fulfilling AP potential for all subjects.

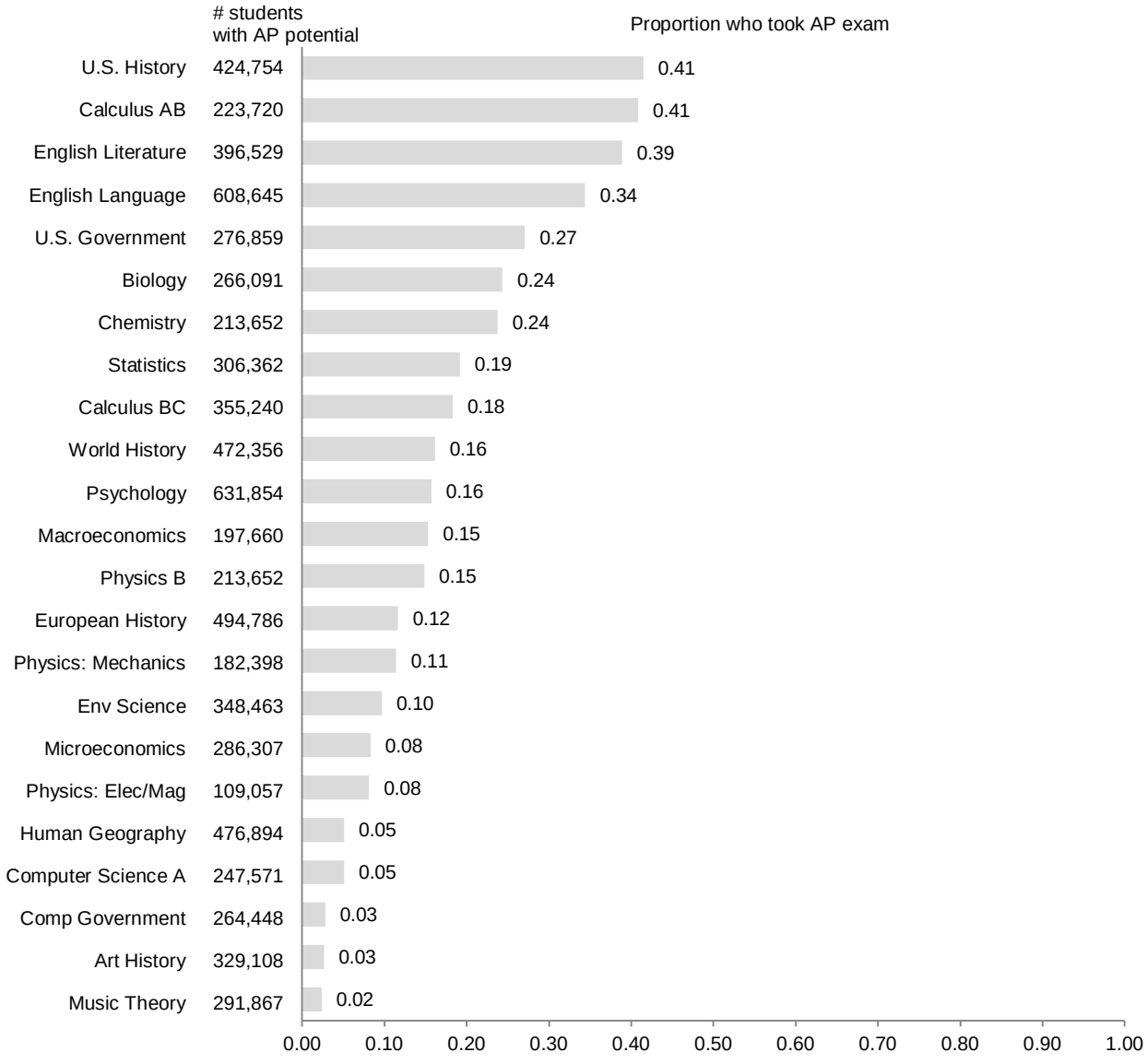

Figure 6. Proportion of all students fulfilling AP potential, by subject.

Disaggregating the data by ethnicity revealed additional differences in the rates at which Black, White, Hispanic and Asian students with high AP potential took various AP exams. For instance, the Black-White gap ranged from -2.6 pts in Calculus BC (where 12.6% of Black students with the potential to succeed in Calculus BC actually took the exam, compared to 15.2% of White students) to +6 pts in World History (where 20% of Black students with the potential to succeed in World History took the exam, compared to 14% of White students). The Hispanic-White gap ranged from -0.1 pts in Statistics (where both Hispanic and White students with potential to succeed in Statistics took the Statistics exam) to +9 pts in English Language (where 41% of the Hispanic students with the potential to succeed in this subject took the exam, compared to just 32% of White students with potential). See Table 12 in the Appendix for subject-by-subject rates of fulfilled AP potential, disaggregated by ethnicity.

Asian students were consistently more likely to have taken an AP exam for which they had high potential than their non-Asian peers. However, as Figure 7 illustrates, this disparity was most pronounced in the Science and Math fields, where Asian students with high potential to succeed in AP Science and Math subjects fulfilled this potential at *almost double* the rates of their White, Hispanic and Black peers with similar potential.

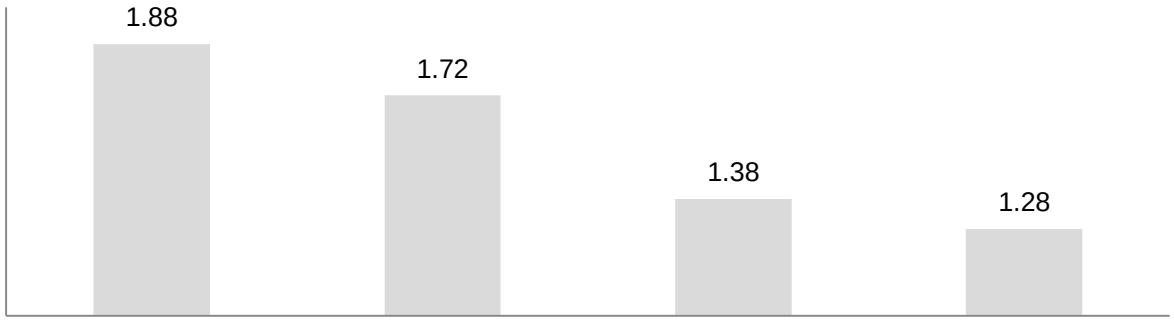

Figure 7. Odds-ratio of Asian-to-Non-Asian students fulfilling AP potential, by field.

Drilling into the subject-level data (Table 4), this trend of Asian students with high potential engaging in AP Math and Science exams at almost double the rates of their equally qualified non-Asian peers was consistent across almost all Math and Science courses, from the core subjects of Biology, Chemistry and Physics to the less commonly taken Statistics, Computer Science and advanced Calculus BC. The two exceptions to this pattern were Calculus AB (the most popular AP math course) and Environmental Science (often perceived as the "easy" science) – where there was rough parity across racial groups.

Table 4

Proportion of students fulfilling AP potential in Science and Math, by race/ethnicity

Subject	Asians	Blacks	Hispanics	Whites
Science				
Biology	0.42	0.23	0.24	0.21
Chemistry	0.40	0.20	0.21	0.20
Physics B	0.21	0.12	0.16	0.13
Physics Mechanics	0.19	0.09	0.10	0.10
Physics Elec/Magnetism	0.14	0.06	0.07	0.07
Computer Science A	0.11	0.04	0.04	0.04
Environmental Science	0.12	0.09	0.11	0.09
Math				
Calculus BC	0.34	0.13	0.15	0.15
Statistics	0.30	0.17	0.17	0.17
Calculus AB	0.43	0.39	0.42	0.40

Proportion of students with high AP potential who attended schools that offered AP

National

For this part of the analysis, the dataset was restricted to students who had high AP potential and had known school information. This resulted in a dataset of n = 707,774 students with high AP potential (2,756 (0.4%) of the total 710,530 students with high AP Potential were omitted from this part of the analysis because of missing information).

As discussed above, while roughly 70% of students who demonstrated high AP potential took at least one AP exam, about 30% took none. As may be expected, 93% of students with fulfilled AP potential attended schools that offered at least one AP course for which they had potential. However, as illustrated in Figure 8 below, a large majority of students with *unfulfilled* AP potential also attended schools that offered at least one course for which they had the potential to succeed.

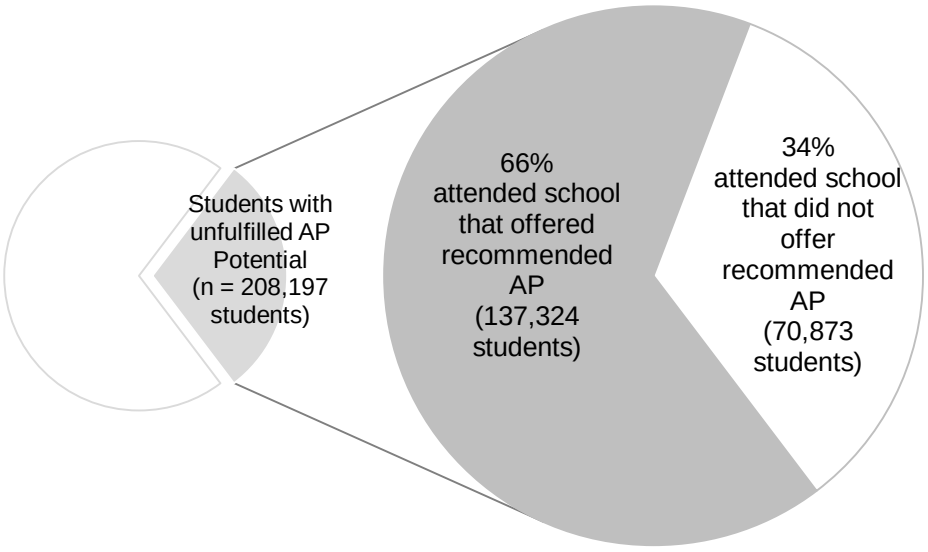

Figure 8. Proportion of students with unfulfilled AP potential whose school offered at least one AP course for which they had potential.

By race/ethnicity, Asian, Black, and Hispanic students with unfulfilled AP Potential were more likely than their White peers to attend schools that offered at least one of their recommended AP courses. See Figure 9 below.

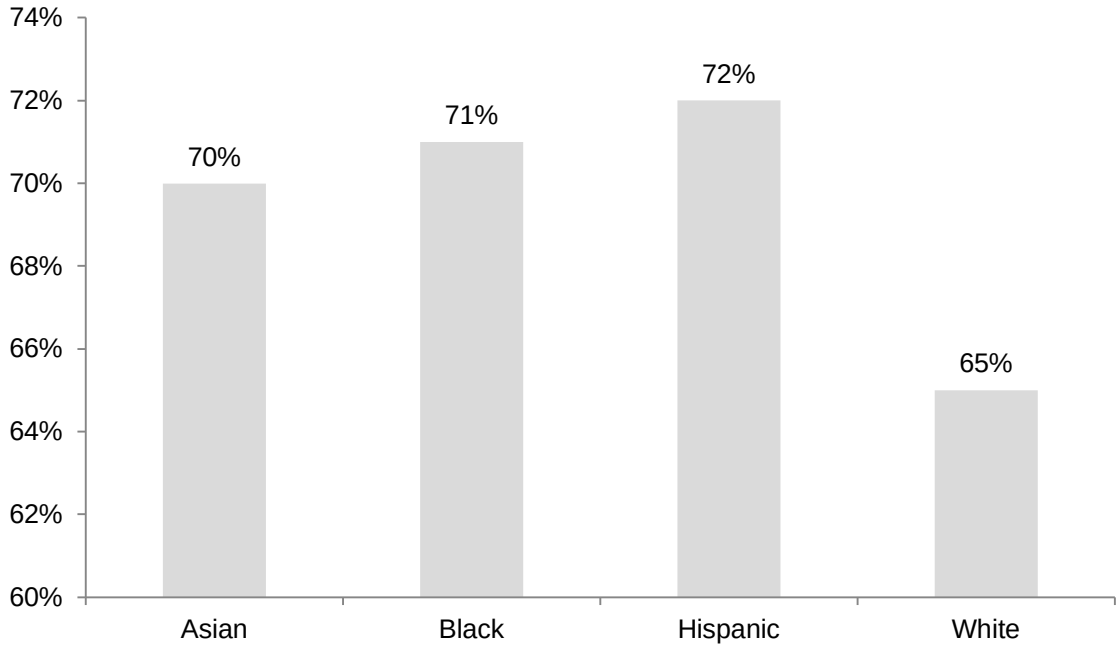

Figure 9. Proportion of students with unfulfilled AP potential whose school offered at least one AP course for which they had potential, by race/ethnicity.

By State

The percentage of students with unfulfilled AP potential who attended schools that offered at least one of their recommended courses varied across states, ranging from 24% in ND to 82% in MD. In 38 states and DC, half or more of the students with unfulfilled AP potential attended a school that offered at least one of the courses for which they had demonstrated potential. See Figure 10.

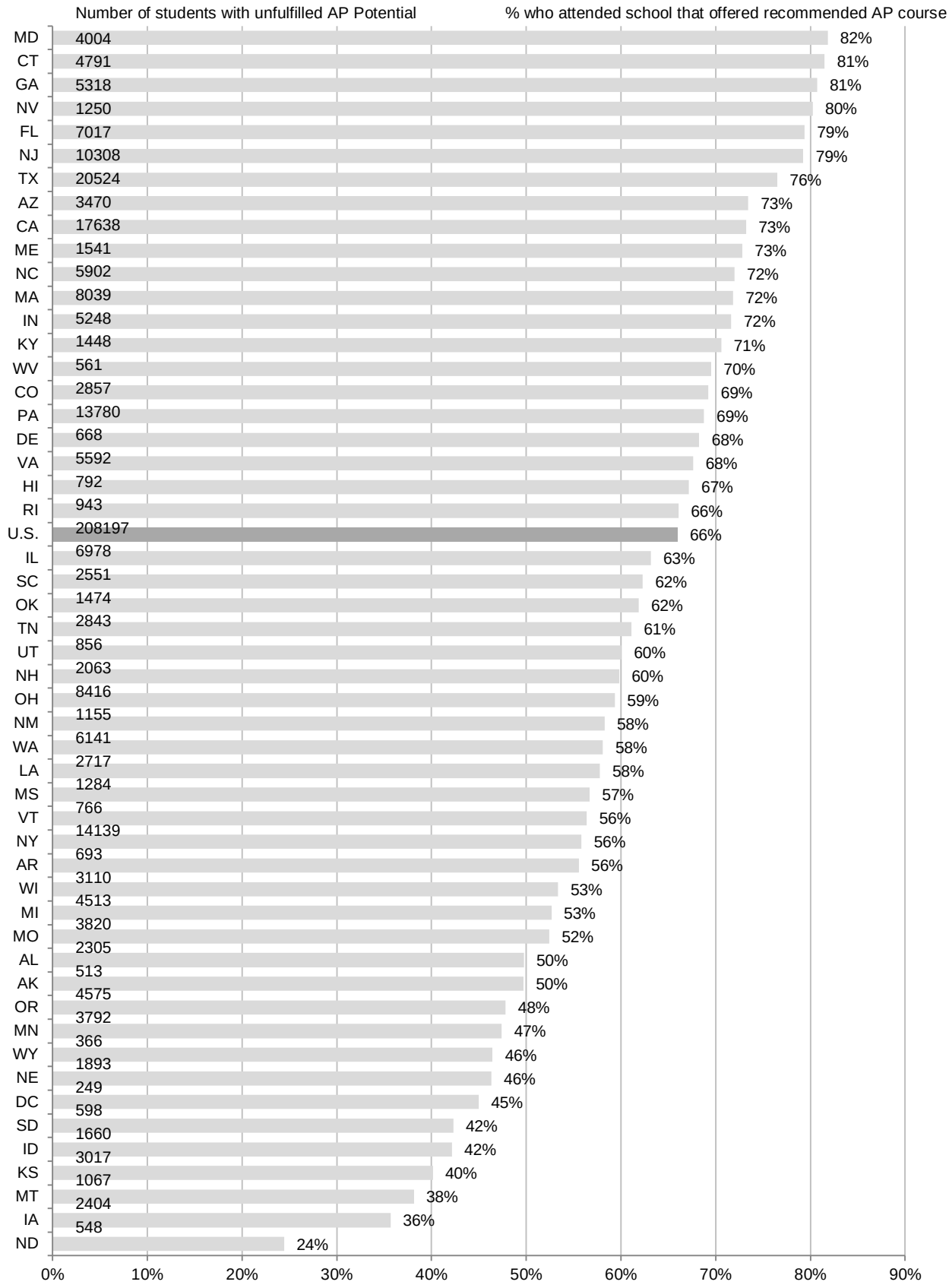

Figure 10. Students with unfulfilled AP potential whose school offered at least one AP course for which they had potential, by state.

Within and across states, there were differences in the rate at which students of different ethnic/racial groups attended schools that offered AP courses for which they had high potential. For example, in New Hampshire, 40% of Black students with unfulfilled AP Potential attended a school that offered AP, compared to 61% of whites. This ratio was flipped in Kansas, where 60% of Black students with unfulfilled AP Potential attended a school that offered AP, compared to 39% of Whites. The differences ranged from -43 points in Idaho (where 0% of Black students with unfulfilled AP Potential attended a school that offered at least one course for which they had potential, compared to 43% of White students) to +59 points in South Dakota (where 100% of Black students with unfulfilled AP Potential attended a school that offered at least one course for which they had potential, compared to 41% of White students), with an average difference of + 6.5 points (Black students with unfulfilled AP Potential more likely to attend a school that offered AP) and a standard deviation of 16 pts.

A similar pattern emerged between Hispanic and White students, where differences ranged from -36 points in West Virginia (33% of Hispanic students with unfulfilled AP Potential attended a school that offered at least one course for which they had potential, compared to 69% of White students) to +44 points in South Dakota (86% of Black students with unfulfilled AP Potential attended a school that offered at least one course for which they had potential, compared to 41% of White students). The mean difference was +1.3 points (Hispanic students with unfulfilled AP Potential more likely to attend a school that offered AP), with a standard deviation of 11 pts. See Table 13 in Appendix B for state-by-state details, by ethnicity.

By Subject

By subject, the proportion of students with unfulfilled AP potential for a particular subject whose school offered that AP course ranged considerably, from 8% in Comparative

Government to 63% in English Lit and 65% in Calculus AB. (See Figure 11). The top five subjects that had the highest percentage of students with unfulfilled AP potential attending a school that offered the course were: Calculus AB, English Literature, U.S. History, English Language and Biology. As Table 5 illustrates, this pattern generally held for each racial/ethnic group, though with Asian students, Chemistry (rather than English language) was among the top five subjects where the highest percentage of students with unfulfilled potential had access to the course.

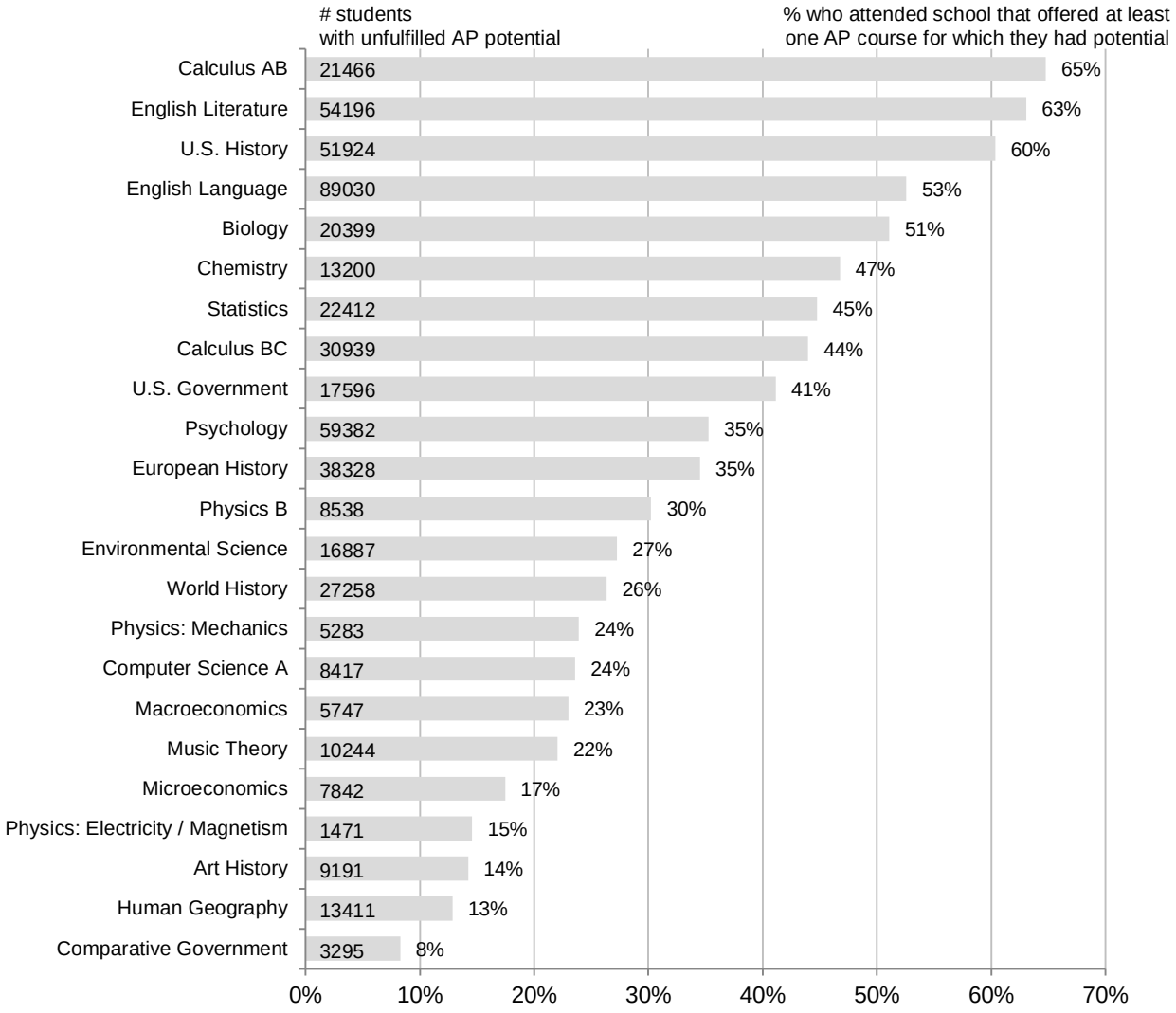

Figure 11. Students with unfulfilled AP potential whose school offered at least one AP course for which they had potential, by subject.

Table 5

Subjects with the Highest Percentage of Students with Unfulfilled AP Potential Attending Schools that Offered the Course, by Race/Ethnicity

All Students	Asians	Blacks	Hispanics	Whites
1. Calc AB (65%)	1. Calc AB (69%)	1. Calc AB (72%)	1. Calc AB (72%)	1. Calc AB (63%)
2. Eng Lit (63%)	2. U.S. Hist (64%)	2. Eng Lit (69%)	2. Eng Lit (71%)	2. Eng Lit (62%)
3. U.S. Hist (60%)	3. Eng Lit (63%)	3. U.S. Hist (67%)	3. U.S. History (69%)	3. U.S. His (59%)
4. Eng Lang (53%)	4. Chemistry (56%)	4. Eng Lang (62%)	4. Eng Lang (65%)	4. Eng Lang (50%)
5. Biology (51%)	5. Biology (56%)	5. Biology (60%)	5. Biology (59%)	5. Biology (50%)

Across all subjects, Asian, Black and Hispanic students with unfulfilled AP Potential were more likely than their white peers to be in a school that offered a given AP course. The largest difference between racial/ethnic groups was in World History, where 40% of Hispanic students with unfulfilled AP Potential attended a school that offered AP World History, compared to 24% of Whites. The smallest difference was in Comparative Government, where 12% of Asian and Hispanic students with unfulfilled AP Potential attended a school that offered AP Comparative Government, compared to 8% of White students with unfulfilled AP Potential. See Table 14 in Appendix B for subject-by-subject details, by ethnicity.

Effect of AP enrollment policy on schools' rate of AP Potential fulfilled

As discussed in the literature review, schools use an array of factors to identify and enroll students in AP courses. Descriptive statistics were calculated to determine the frequency with which schools used local measures of academic readiness (such as grades, prerequisite courses, or teacher recommendation), student or parent input, and/or the PSAT/NMSQT. The dataset was

restricted to schools that had students with high AP potential and provided data on their AP enrollment policies during either 2010-11 or 2011-12 (n = 14,014 schools). Of these roughly 14,000 schools, 27% reported using PSAT/NMSQT to recommend students for AP (almost always with other factors; only four schools reported used PSAT/NMSQT exclusively); 17% reported using exclusively local academic qualifications such as grades, prerequisite courses or teacher recommendations, while 56% reported using student and parent input, possibly with grades or teacher recommendations, but without the PSAT/NMSQT.

As presented in Table 6 below, schools that used PSAT/NMSQT had a higher average proportion of students fulfilling AP potential, compared to schools that used exclusively local academic criteria or student and parent input (without PSAT/NMSQT). This pattern was consistent both for all students, as well as for the disaggregated rates at which schools fulfilled their Black, Hispanic, Asian and White students' potential.

Table 6

Percentage of Schools' Students Fulfilling AP Potential (APP), by AP Enrollment Policy and Race/Ethnicity

	All Students			*Black Students*			*Hispanic Students*		
AP Enrollment Policy	*N*	Mean % APP fulfilled	*SD*	*N*	Mean % APP fulfilled	*SD*	*N*	Mean % APP fulfilled	*SD*
Used PSAT/NMSQT	3752	74%	20.5	2260	70%	34.2	2497	75%	30.4
Used student or parent input (without PSAT/NMSQT)	7840	68%	26.5	3453	67%	37.7	4409	71%	35.1
Used grades or teacher recommendation only (without student/parent input or PSAT/NMSQT)	2422	60%	30.6	1025	61%	39.5	1259	65%	37.5

	Asian Students			*White Students*		
AP Enrollment Policy	*N*	Mean % APP fulfilled	*SD*	*N*	Mean % APP fulfilled	*SD*
Used PSAT/NMSQT	2332	83%	27.1	3560	73%	21.4
Used student or parent input (without PSAT/NMSQT)	4085	81%	30.2	7446	68%	27.4
Used grades or teacher recommendation only (without student/parent input or PSAT/NMSQT)	1232	75%	34.2	2266	60%	31.4

Multinomial logistic regression was used to further explore the effect of school AP enrollment policy on the percentage of a school's students who fulfill high AP potential *after* controlling for other factors that the literature indicates are relevant predictors of AP access. Table 7 summarizes the regression results for all students, presenting all variables with statistically significant effects on the proportion of students in a school who fulfilled AP potential. AP enrollment variables are highlighted in black text.

Table 7

Multinomial Regression Model for All Students: Variables with Statistically Significant Effects on School % of AP Potential Fulfilled (APPF)

Comparison Category	Reference Category				
	Category 1 (0% APPF)	Category 2 (.0001-25% APPF)	Category 3 (25.0001-50% APPF)	Category 4 (50.0001-75% APPF)	Category 5 (75.0001-99.9999% APPF)
Category 2: .0001-25% APPF	# APP students (1.168)*** % minority (.991)**				
Category 3: 25.0001-50% APPF	# APP students (1.165)*** # AP courses (1.355)*** City (.613)*	# AP courses (1.307)*** HS Enrollment (.999)*** % Minority (1.011)***			
Category 4: 50.0001-75% APPF	# APP students (1.171)*** Uses PSAT (1.585)* City (.475)**	# AP courses (1.602)*** HS Enrollment (.999)*** % Minority (1.010)** Uses PSAT (1.433)* Uses stud/par (1.311)*	# APP students (1.005)** # AP courses(1.226)*** City (.774)*		
Category 5: 75.0001-99.999% APPF	# APP students (1.168)*** # AP courses (1.924)*** Uses PSAT (1.895)** Uses stud/par (1.329)* City (.631)*	# AP courses (1.856)*** HS Enrollment (.999)*** % minority (1.013)*** Uses PSAT (1.713)** Uses stud/par (1.559)**	# AP courses (1.420)*** HS Enrollment (.9998) Uses PSAT (1.420)**	# APP students (.997)*** # AP courses (1.158)*** % minority (1.003)* Uses PSAT (1.196)* Uses stud/par (1.189)* City (1.329)***	
Category 6: 100% APPF	# APP students (.956)** # AP courses (1.925)*** % minority (1.007)* Uses stud/par (1.333)* City (0.474)***	# APP students (.818)*** # AP courses (1.857)*** HS Enrollment (.999)*** % minority (1.015)*** Uses stud/par (1.564)**	# APP students (.820)*** # AP courses(1.421)***	# APP students (.816)*** # AP courses (1.159)*** % minority (1.005)**	# APP students(.819)*** Suburb (.732)*

Note. Numbers in () represent odds ratios, Exp(B). For the categorical variable "AP enrollment policy," the reference value was "uses grades/teacher recommendation only." For the categorical variable "Locale Type," the reference value was "Rural."
* p < .05; ** p < .01; *** p < .001

The multinomial regression model indicates that, after controlling for a number of other characteristics, schools that used PSAT/NMSQT to identify and recommend students for AP were consistently more likely to have 75-99% of their students fulfilling high AP Potential compared to schools that only used grades or teacher recommendations. (The number of AP courses offered was the only other variable with a similarly consistent positive relationship with higher rates of fulfilled AP potential.) Schools that used student or parent input were also more likely to have over 50% of their students fulfilling AP potential, although the effect size was smaller and slightly less consistent compared to the use of PSAT/NMSQT. AP enrollment policy had the second largest and most consistent effect, after the number of AP courses offered by the school (see Figure 12).

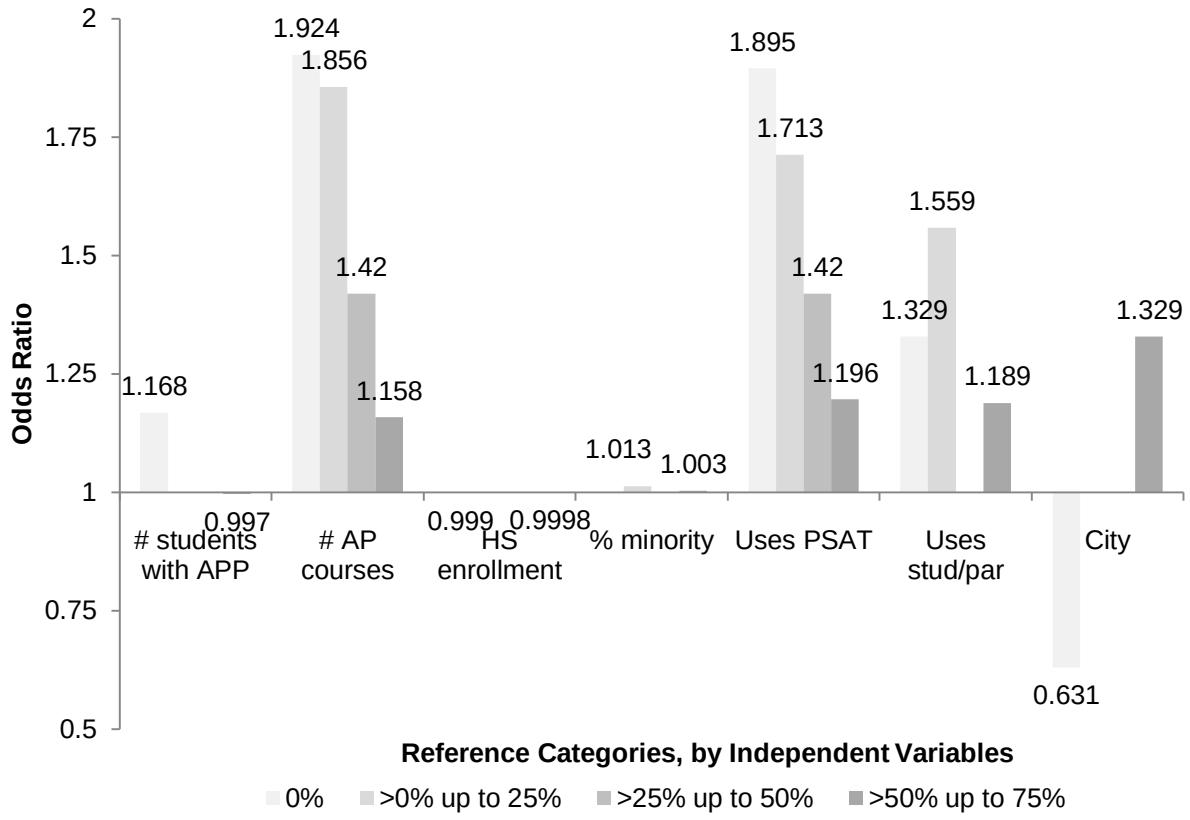

Figure 12. Statistically significant odds ratios of school having 75-99% AP potential fulfilled, by variable.

However, disaggregating by race/ethnicity reveals that the positive relationship between using PSAT/NMSQT and higher fulfilled AP potential was driven primarily by the effects for White students. As Figure 13 illustrates, while using PSAT/NMSQT rather than only grades/teacher recommendation had a consistently positive effect on increasing the likelihood at which schools fulfilled White students' AP potential, it had inconsistent effects on the rate at which schools' fulfilled Black, Hispanic or Asian students' AP potential. In fact, schools that reported used PSAT/NMSQT actually had lower odds of fulfilling 75-99% of their Hispanic and Asian students' AP potential. This latter finding is the opposite effect seen for White students and the aggregate group. See Appendix C: Effects of School AP Enrollment Policy, by Race/Ethnicity

Table 15, Table 16, Table 17, and Table 18 in Appendix C for a summary of all statistically significant effects, by race/ethnicity.

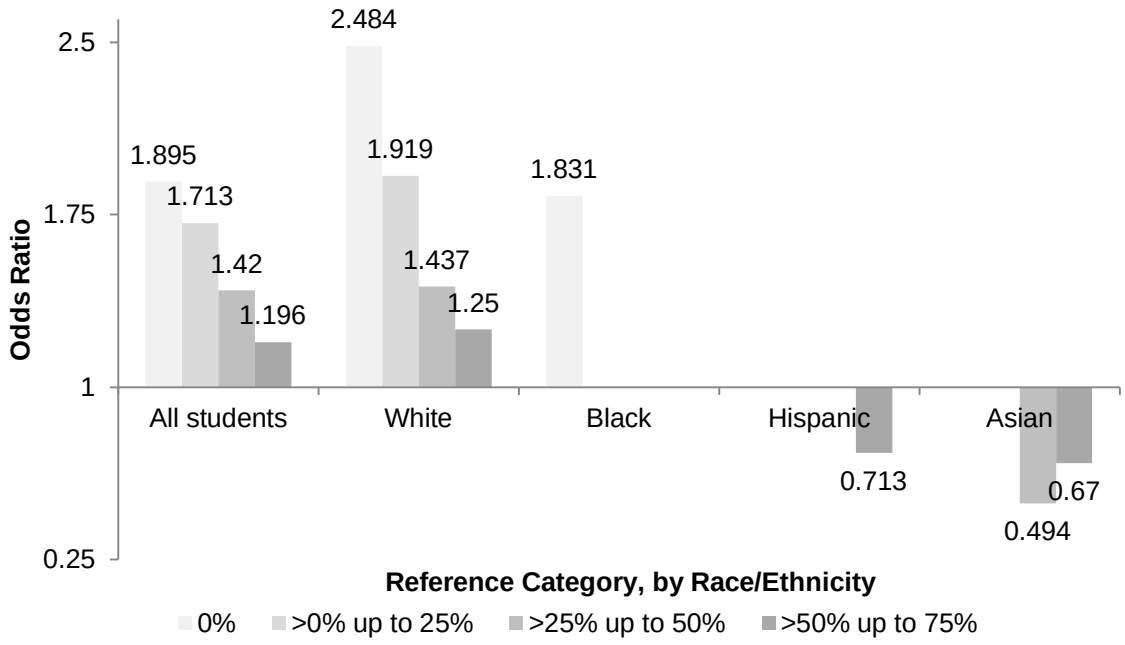

Figure 13. Statistically significant odds ratios of school having 75-99% AP potential fulfilled, when using PSAT instead of only grades/teacher recommendation.

Each model was statistically significant over the null model at $p < .001$. Table 8 presents the number of schools with valid data used for each model, as well as the pseudo r^2 and number of cases the models classified correctly. The models classified between 45-60% of cases correctly and, overall, tended to predict schools had higher rates of fulfilled AP potential than they actually did. Appendix C includes the detailed classification tables for each model.

Table 8

Multinomial Logistic Regression Models: Summary Characteristics

	All students	Black	Hispanic	Asian	White
N	10454	5006	6082	7186	9891
Nagelkerke r^2	0.506	0.275	0.399	0.443	0.471
Total percentage of cases predicted correctly	51.2%	45.3%	48.3%	60.4%	47.7%

Differences between Students Fulfilling AP Potential vs. Students who Did Not

The final question posed by this study asked how, within each racial/ethnic group, students with high AP potential who ultimately took at least one AP exam differed from those who took no AP, focusing specifically on student-level characters such as gender, primary language, cumulative GPA, father and mother's education, and postsecondary degree aspirations. Logistic regression was used to explore this question, with each model restricted to cases with valid data for all variables. The dichotomous outcome variable was whether or not the student with AP potential took AP (1 = took at least 1 AP exam, 0 = took no AP exams).

As can be seen in Table 9 below, students' cumulative grade point average (GPA) had the largest positive effect size of all variables. Across all groups, each point increase in GPA

increased a student's odds of fulfilling AP Potential by between 167% and 282%. GPA appeared to have the largest effect with Asian students (282%) and the smallest for Black students (167%).

Males had lower odds of fulfilling high AP Potential than females for all groups except Asians. Being male decreased the average Black, Hispanic and White student's odds of fulfilling AP potential by 24%, 14% and 8%, respectively compared to their female peers of the same race/ethnicity.

Table 9

Influence of Student-level Characteristics on Fulfilling AP potential, by Race/Ethnicity: Summary of Logistic Regression Results

	Asian	Black	Hispanic	White
	Number of cases included in analysis			
N (% of total cases)	48,624 (61.5%)	16,099 (48.5%)	31,239 (52.4%)	248,588 (49%)
Variables	Exp(B)			
Gender (Male)	1.028	0.763***	0.864***	0.921***
Primary Language (English and Another Language)	0.942	0.892	1.006	0.733***
Primary Language (Another Language)	0.452***	0.475*	0.570***	0.532***
Cumulative GPA	3.824***	2.666***	3.094***	3.701***
Father's highest education	1.039***	1.040***	1.010	1.097***
Mother's highest education	0.978**	1.006	0.986*	1.083***
Postsecondary degree goal	1.040***	1.063***	1.063***	1.053***
Constant	0.027***	0.017***	0.025***	0.001***
	Pseudo r^2			
Nagelkerke r^2	0.087	0.098	0.093	0.131
	Percentage of cases predicted correctly			
AP Potential unfulfilled	1.7%	10.9%	6.0%	14.5%
AP Potential fulfilled	99.8%	96.6%	98.6%	96.5%
Total	89.5%	73.2%	78.3%	75.9%

*** p < .001, ** p < .01, * p < .05.

For all groups, having a language other than English as one's primary language decreased students' odds of fulfilling AP Potential by almost half, compared to primarily English speakers. Being bilingual had no statistically significant effect on Asian, Black or White student's odds of fulfilling AP potential, but did decrease White students' odds of fulfilling AP potential by 27%.

Father's education, mother's education and postsecondary degree aspirations also had statistically significant effects on students' odds of fulfilling AP Potential. Across all groups, one unit increase in degree aspirations increased a student's odds of fulfilling AP Potential about 4-6%. Father's education had the largest effect with White students: each additional year of education increased the average White student's odds of fulfilling AP Potential by 10%, compared to 4% for Asians and Blacks, and a statistically insignificant effect for Hispanics. Mother's education had a small negative effect on Asian and Hispanic students' odds of fulfilling AP Potential (1-2% decrease in odds for each additional year of mother's education), no statistically significant effect on Black students' odds, and a positive effect on White students' odds (8% increase).

Overall, the models offered statistically significant but relatively small improvements over the null model. While the model predicted fulfilled AP Potential well across all groups (classifying 96.5-99.8% of cases correctly), it failed to classify *unfulfilled* AP Potential well (with only 1.8-14.5% of students with unfulfilled AP potential classified correctly).

CHAPTER FIVE: DISCUSSION

At the outset of this study, national data had just begun to emerge suggesting that a majority of students with the potential to succeed in advanced coursework were not taking them, and that this AP potential opportunity gap was significantly wider for high-achieving Black and Hispanic students compared to their similarly qualified White and Asian peers. Beyond the aggregate numbers, we did not know whether this problem was a consistent issue nationwide or a highly varying localized one, much less what was causing it or what could be done to solve it (though the existing body of literature on AP access provided some helpful hypotheses that this study tested). To fill in these blanks, this study set out to identify the topography of the data and create an initial map that could point us to where the problem was most severe, where it may be being successfully addressed and what some of the predictive or related factors might be. At the same time, we expected to raise additional questions that could inform practice and guide future research.

What we have learned is that, in some areas, the situation is better than anticipated. In other areas, the continuing inequities and challenges are astounding. This chapter first examines the big picture then zooms in for a close-up view. Next, it discusses the data that shows AP opportunity is just down the school hallway for many students with unfulfilled AP potential. Finally, it examines the influence of school AP policy and student-level characteristics, before closing with limitations and final considerations for future research. Each subsection interweaves what the numbers tell us with suggestions for research and practice.

The Big Picture

This study focused on the rate at which academically qualified students were fulfilling AP potential, but in the process, found confirmation that there is an even starker problem one

step earlier in the pipeline – at the point of preparation. *Only 10% and 14%* of Black and Hispanic students who took the PSAT/NMSQT demonstrated high AP Potential according to that measure[6], compared to virtually half of their Asian and White peers – suggesting that the vast majority of Black and Hispanic students are not being academically prepared to engage in advanced, college-level coursework at the same pace as their Asian and White peers. This finding tracks with the well-documented achievement gap between Black/Hispanic and Asian/White students, and underscores the inequities in preparation and opportunity that too many Black and Hispanic students face.

On a potentially promising note, the national aggregate AP potential gap for the Class of 2012, while still considerable, appears to be less severe than as reported for the Class of 2011. As illustrated in Figure 14, while the College Board reported that only 20%, 30%, 38%, and 58% of Black, Hispanic, White and Asian students in the Class of 2011 with high AP potential took a recommended AP exam (College Board, 2011c), the proportions were significantly higher for the Class of 2012, at 49%, 56%, 55% and 72% for Black, Hispanic, White and Asian students. Moreover, an additional 12-18% of students took a non-recommended AP exam. Hispanic students with high AP potential actually participated in AP exams at *higher* rates than their White peers.

[6] It is important to reiterate here that just because student's PSAT/NMSQT scores do not predict a high likelihood of success in AP does not mean they have zero potential to succeed in an advanced course. As the College Board itself states, PSAT/NMSQT data should not be used exclusively to determine whether a student is ready for AP, or to prevent students from enrolling. There are other factors that are important to AP success, such as student interest and motivation, that cannot be quantified by academic measures, and many students who may not have been predicted to succeed in AP based on grades, teacher recommendation or PSAT scores nonetheless do.

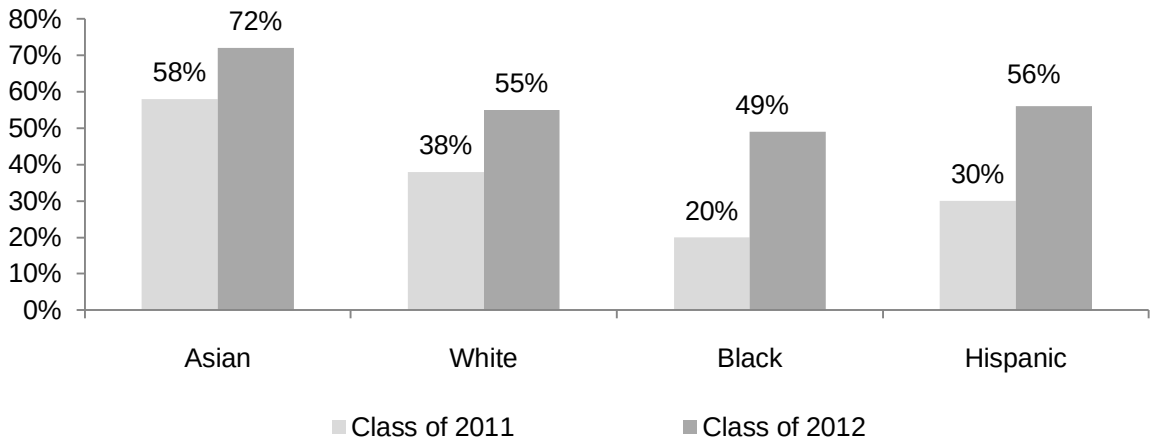

Figure 14. Percentage of students with high potential who took at least one of the AP exams for which they had high potential, Class of 2011 vs. Class of 2012.

These twin findings raise several key questions for research and practice.

First, what can be done to achieve parity in the rates at which Black and Hispanic students are prepared for AP and demonstrate high AP potential? Future research could identify schools or districts that have high rates of Black and Hispanic students demonstrating high AP potential and through qualitative approaches such as surveys, observations and interviews, explore what these schools and districts are doing to close the preparation gap for these students. The answers to this question may help to inform the larger effort to close the achievement gap and identify models and strategies for how to effectively provide Black and Hispanic students with the kinds of elementary and middle school learning experiences that help them gain a deep command of the reading, writing and mathematical skills and knowledge needed to succeed in college-level coursework. In the meantime, teachers, principals, administrators and policymakers can analyze their own PSAT/NMSQT data to see who is demonstrating and fulfilling AP potential in their high schools and any disparities. They can then use these data to understand who is in greatest need of intervention, develop hypotheses about why some students

are disproportionately less prepared than others, and craft strategies to improve teaching and learning in their own classrooms. The data analysis can also help them pinpoint whether they may have preparation gaps (students just not demonstrating high AP potential), access gaps (students demonstrating high AP potential but not taking AP), or both.

Second, why do we see such considerable improvement from the Class of 2011 to the Class of 2012 in the rates at which students are fulfilling potential? Several things may be contributing to the difference between the Class of 2011 and the Class of 2012 results. The College Board report included only public school students while the current study included both public and private school students. There may have been differences in methodology between the College Board's report and this study. Finally, part of the difference could be due to real growth from one cohort to the other. Without an apples-to-apples comparison, it is impossible to determine. To understand trends over time, future research could take an intentionally longitudinal approach. Such research would help us understand where the problem is improving, worsening, or holding steady, as well as set a baseline for whether this data is highly volatile (changing significantly from year to year) or relatively stable. At a local level, practitioners can analyze their own data, determine their own baseline, and track progress over time to assess the efficacy of efforts to close the AP potential gap.

The Close-Up View

Disaggregating the data unmasked considerable differences between racial/ethnic groups both within and across states. States such as Arkansas, Georgia, Colorado and Florida did a relatively strong job at fulfilling their Black students AP potential, with over 75% of Black students with high-potential taking at least one AP exam. In contrast, less than half of similarly qualified Black students were taking AP in states like New Hampshire, Louisiana, Oregon and

Wyoming. While some states like Florida and Arkansas had consistently high rates of students fulfilling AP potential across all ethnicities, other states like Alaska, New Mexico and Nebraska had gaps of almost 30 percentage points between racial/ethnic groups.

What is contributing to these differences between and within states and schools? Differential state policies? Differential funding? Demographic differences? Curricular differences? To explore this, future research could take a state-level case study approach, diving deep into states at different points in the spectrum for fulfilling AP potential to help identify the policy, cultural, funding, and other factors that may be contributing to either the success or failure in fulfilling students' AP potential. It would be informative to compare states that are demographically or geographically similar but have different rates at fulfilling AP potential, to see what differentiates them.

One surprising finding is that the inequities between groups were not unidirectional. For example, as expected, most states had higher rates of White students fulfilling AP potential than similarly qualified Black students. However, 10 states (Oklahoma, Kansas, Colorado, Florida, Mississippi, Alabama, Arkansas, Iowa, Idaho and Nebraska) actually did a *better* job of fulfilling their Black students' potential than their White students'. Future research may want to focus on these 10 states to identify what may be contributing to the elimination and/or reversal of the typical Black-White potential gap. As discussed above, practitioners and policymakers could also examine their own data to understand whether they have untapped potential in their own schools, whether this problem disproportionately affects some groups of students, why this may be, and then implement strategies to address this problem. To support practitioners in this effort, the College Board might consider developing a digital dashboard that immediately shows district, school and state staff to what extent their students are demonstrating and fulfilling high

AP potential, by subgroup. This could supplement the existing AP Potential tool, so that it becomes a comprehensive resource that tangibly identifies not just who has AP potential, but the extent to which these students are actually engaging in rigorous opportunities. As an alternative for districts or states that already have their own robust data and dashboard systems, the College Board could develop a data file and transfer process that could be easily integrated into those existing systems.

The data also revealed considerable variation in the percentage of students fulfilling AP potential by subject. The subjects where the most students fulfilled AP potential (English Literature and Language, U.S. History, Calculus AB and U.S. Government) were also the most commonly offered and taken AP courses, with hundreds of thousands of students taking these exams each year (College Board, 2012a). In contrast, subjects with the least percentage of students fulfilling AP potential, such as Music Theory, Art History and Comparative Government, are rarely offered and were taken by less than 15,000 students in the Class of 2012. This alignment between fulfilled potential and course popularity suggests that the subject-level differences may be related to school-level supply and student-level demand. To round out their course offerings and perhaps engage more students who may not be interested in the core AP courses, schools may want to examine their own data to see if there may be less traditionally offered courses for which there might be both student potential and student demand.

Moreover, in a time when there has been a national call for more science, technology, math and engineering talent, the data show that there is tremendous untapped potential to excel in these fields across all ethnic groups, and especially amongst non-Asian students. Principals, teachers, district administrators, state and federal policymakers, and foundations and advocacy

groups interested in expanding the number of students who enter STEM fields could use this data to inform recruitment efforts and course offerings.

Opportunity within Reach

One key finding from this study is that, nationally, a full two-thirds of students with unfulfilled AP potential attended a school that offered at least one subject for which they had strong potential to succeed. This percentage ranged up to 82% in Maryland and down to 24% in North Dakota, with 39 states and DC having at least half of their students with unfulfilled AP potential attending schools that offered one of their recommended AP courses. What this means is that, in many instances, the problem of unfulfilled AP potential is not due to a lack of course offering. Most students with unfulfilled AP potential are going to schools that actually offer AP; there is some other reason for why they are not taking the exams.

Future qualitative research could help to shed light on what is keeping students who have high potential for AP from taking even one AP exam, even when their schools offer it. Interestingly, non-white students with unfulfilled potential were slightly more likely to attend schools that offered a corresponding AP exam than their white peers with unfulfilled potential (though this varied across states). This aligns with earlier studies finding a "school-within-school" phenomenon, in which Blacks/Hispanics were less likely to take AP even when their schools offered it. The current findings suggest that this phenomenon may hold even for students of color with demonstrated academic potential for advanced coursework, though actual qualitative research would be needed to confirm this.

In sum, the data suggest that there are a number of students with the potential to immediately enter into existing AP courses and succeed, particularly in core courses, where over half of students with unfulfilled AP potential are already at schools that offer the course.

Practitioners and policymakers may consider examining why these students are not engaging in AP when they already have access and explore how they can address this problem. As suggested above, schools may consider analyzing how many students have high AP potential to inform their course offerings and master schedules, possibly adding AP courses or sections where there are many students with high potential. Given the data that indicates, especially for core AP subjects such as English, U.S. History and Biology, 50-65% of students who have unfulfilled AP potential are in schools that already offer the subject for which they have potential, schools might be able to enroll students in existing courses that are under-enrolled, or add more sections for existing courses that are already at capacity.

State policymakers might consider supporting school and district administrators by providing funding to train more AP teachers for subjects where there are high numbers of students with high AP potential, sufficient student-level demand, but no available teachers in a given school or district. States may also want to consider supporting online or blended AP courses, to provide access to students whose school does not offer a course for which they have potential. For instance, in California (where nearly 80% of the 84,000 students with high AP potential took at least 1 AP exam), the University of California has long-sponsored online AP courses free to all high school students in the state.

Schools, districts and states may also consider developing policies that automatically enroll students into advanced or honors courses if they demonstrate potential (whether through grades, teacher recommendation or PSAT/NMSQT), such that students or their parents would need to intentionally "opt-out" of these courses rather voluntarily "opt-in." A handful of districts, such as Federal Way in the Seattle area of Washington, have tried this approach with significant success in increasing student AP participation.

It is a truism that what gets measured matters. A final strategy for consideration might be to incorporate metrics related to fulfilling AP potential in school, district or state goals and/or accountability models. As with any of the suggestions included here, this kind of strategy should be monitored to see whether it results in more students accessing advanced academic opportunities, has no effect, or yields unintended, undesired consequences.

Influence of School AP Policy

As may have been predicted, schools that used PSAT/NMSQT scores to encourage students to enroll in advanced courses had higher rates of students fulfilling AP potential, compared to schools that used only teacher recommendation or grades. On the one hand, this makes intuitive sense. If AP potential is defined using PSAT performance, then schools that use PSAT scores should hopefully, by definition, be identifying more students with PSAT-predicted AP potential and enrolling them into AP courses. Schools that use only local teacher recommendations or grades may simply not know that some students have PSAT-predicted high AP potential, with the result that these students are not identified for AP courses and the school has a lower rate of fulfilling students' AP potential.

On the other hand, the fact that, after controlling for other school characteristics, this positive relationship between PSAT usage and fulfilling AP potential held only for White students (while having inconsistent, no, or negative effects for Black, Hispanic or Asian students) suggests that schools may be using PSAT data differently for different groups of students. Alternatively, schools may be using PSAT data to equitably recruit all students, but simply may not be influencing non-white students' decisions or opportunities to take AP. Future qualitative research could help shed light on why AP enrollment policy has different effects on potential fulfillment rates for whites versus non-whites. One could, for instance, conduct case

studies, interviews and/or surveys of schools that use PSAT/NMSQT and have high rates of fulfilling White students' AP potential and compare them with similar schools that have low rates of fulfilling Black/Hispanic students' potential, to see what might be causing these differential results. Another idea would be to conduct case studies, interviews and/or surveys of schools that use PSAT/NMSQT and have high rates of fulfilling Black and/or Hispanic students' AP potential and compare them with similar schools that have low rates of fulfilling those students' potential. In the meantime, school, district and state administrators could immediately begin to reflect upon how they are using PSAT scores to influence the AP enrollment of different types of students and examine whether they are seeing this usage result in equal rates of AP participation across groups, and if not, explore why not.

Similarly, schools that used parent or student input (but not PSAT/NMSQT scores) tended to have higher rates of White students fulfilling AP potential than schools that used only teacher recommendations or grades. However, student and parent input had no consistent effect on the rates at which non-White students with academic potential engaged in AP. This finding could be due to a number of factors, such as differences in culture, cultural capital, power, and knowledge of how to advocate for oneself or one's child. Additional qualitative research, as well as action research from practitioners and policymakers, could help us better understand why we observe such differential effects and craft solutions for how to address them.

Finally, while the model used by the current study was significantly different from the null model, it predicted only 45-60% of cases correctly. This indicates that there is still a considerable amount of variation that is *not* accounted for by the variables included in this model. In other words, there are other factors beyond number of students with high AP potential, number of AP courses, school size, percentage low-income and minority, locale, and

AP enrollment policy that are shaping the extent to which schools are fulfilling their students AP potential. Further qualitative research could suggest additional school-level variables that might be influencing AP-taking behavior.

Influence of Student-level Characteristics

At the student-level, being male, being an English learner, and having a lower GPA significantly decreased a student's likelihood of fulfilling AP potential. Meanwhile, higher father's education and higher postsecondary degree goal aspirations tended to increase a students' likelihood of fulfilling AP potential. Mother's education had mixed effects, slightly decreasing Asian and Hispanic students' likelihood of fulfilling AP potential, increasing White students' likelihood, and having no effect on Black students.

Given the body of literature regarding the growing achievement gap between girls and boys, particularly Black boys, the finding that males were significantly less likely than their female counterparts to fulfill AP potential is not surprising, though still disturbing. However, this pattern held only for White, Hispanic and Black males, *not* Asian males, who were actually just as likely as Asian females with potential to take AP. Why do Asian males break the trend? Could there be something there that could help us address the gender gap for other ethnicities? Other questions the data raise include: Why did bilingualism decrease White students' chances of fulfilling AP potential, but not non-White students? And why did mother's education have such mixed effects?

Moreover, while the student-level model was superb at correctly predicting which students fulfilled AP potential (96-99.8%), it failed to predict when a student would *not* fulfill their potential (correctly predicting only 1.7-14.5% of unfulfilled AP potential cases). In other words, the model predicted that almost all students would fulfill high AP potential, when in

actuality, 30% did not. This finding suggests that while parental education, GPA, gender, primary language and degree aspirations are related to whether a student with academic potential will take an AP exam, there are likely other factors not included in the model, such as school-level effects, peer effects, and perhaps other student-level effects, that are important as well. One limitation of this study is that it was a simple, exploratory analysis examining differences at the student-level. A further multi-level analysis could be conducted to combine the school-level and student-level models with other district- or state-level factors to explore whether it better explains the variation in whether students fulfill AP potential.

Meanwhile, school practitioners may want to take these preliminary student-level predictors into account as they identify and recruit students to AP, paying particular attention to groups of students who appear to have a higher likelihood of not fulfilling AP potential. For instance, given the findings that being male and having a lower GPA is associated with lower rates of fulfilling AP potential, practitioners might also want to consider targeted recruitment and/or supports efforts directed at male students, as well as think about using PSAT/NMSQT as a second, nationally standardized data point to identify students who may have lower GPAs but could nonetheless be able to succeed in advanced courses. This could be most immediately actionable in AP subjects that don't have prerequisites and are in subjects typically required for graduation, such as U.S. History or English.

Limitations

While the current study provides a more comprehensive, nuanced, and actionable view into the problem of unfulfilled AP potential than heretofore existed, there are several limitations.

One is that the sample only included students who took the PSAT/NMSQT, roughly 2.2 million students for the Class of 2012. While this comprises roughly 66% of the estimated 3.35

million U.S. public and nonpublic graduates that year (Prescott & Bransberger, 2012), it is not a randomly selected sample of the overall U.S. high school population. Some states pay for the PSAT statewide for all students, while others do not; some states have a widespread culture of PSAT participation, while different tests are more prevalent in other states. Consequently, some states' student populations are more fully represented in the sample, while other states are under-represented (perhaps introducing some hidden selection biases into the sample). The state-level results should thus be interpreted with caution. And while the findings are applicable to a large subset of U.S. high schools and students, given the large size of the sample, caution should be used in generalizing these findings to the full U.S. population. Future researchers may want to partner with states to examine the extent to which the data reflects (or deviates from) the overall student population, and control for these differences accordingly.

A second limitation is that disaggregated data on the Asian population was not available. In self-identifying their race/ethnicity on the PSAT/NMSQT, students do not have the option to indicate whether they are Chinese, Korean, Filipino, Vietnamese, or other specific Asian nationality or ethnicity; the College Board data simply does not capture this detail. Research has shown that the "Asian" students are not a monolithic group, and that while certain sub-groups excel academically, others demonstrate significant academic achievement gaps. School practitioners and policymakers should parse their own data to examine whether there may be disparities amongst their Asian students. The College Board might also consider revising its data questionnaire to allow for this disaggregation.

Thirdly, because the student-level analysis relied on the subset of students who also took the SAT, there could be some hidden selection biases that differentiate that sample of students from the larger sample of students who took the PSAT. Future researchers could work with state

education agencies to match the College Board data to state longitudinal data systems, which would provide a more comprehensive data set, as well as provide additional variables (such as participation in free or reduced lunch programs as a proxy for income) that may have some explanatory effect on whether a student with high AP potential actually takes an AP exam.

Fourth, because the data was limited only to AP, it may underpredict the extent to which students with the potential to succeed in advanced coursework are actually doing so. Some students with high AP potential may have taken another form of advanced coursework, such as IB courses or dual enrollment in local colleges (although, as discussed earlier, IB has only limited availability in the U.S. and there is no centralized, national dataset on students engaged in dual enrollment). Practitioners and future researchers could undertake more localized analyses to understand to what extent students with unfulfilled AP potential are engaging in other options for advanced academics.

Fifth, as discussed earlier, the regression analyses in the study were single-level: one model exploring school-level factors and the second exploring student-level factors. Each model, separately, was moderately successful at predicting cases accurately, which suggested two things: 1) some of the factors examined were statistically significant ones; and 2) there are likely other factors that are also relevant. Future researchers could conduct a multi-level model that incorporates state- or community factors, as well as other key student factors such as income.

Finally, the current study only examined whether students with potential *took* AP, not subsequent performance. A final area of future research could be to take the analysis a step further, and look at the extent to which students with AP potential actually *succeeded* in the AP exams that they took. Examining the extent to which students succeed on AP exams would

provide deeper insight into actual performance, which matters because earning college credit for AP typically requires a score of at least three. A quantitative study could identify disparities or patterns in success rates that need to be addressed. A qualitative study could also dive deep into schools or states that are doing an outstanding job of helping students with AP potential succeed on the AP exams, yielding actionable strategies that could serve as models or best practices that other schools might adopt.

Conclusion

In summary, the current study peels back the layers of the problem of unfulfilled AP potential in a number of ways, yielding a series of questions not only for future researchers, but also for policymakers and practitioners:

1. Why are only 10% and 14% of Black and Hispanic students, respectively, demonstrating AP potential? What can we do to achieve parity in the rates at which Black and Hispanic students are prepared for AP and demonstrate AP potential?
2. Why do we see such considerable improvement from previous research on the Class of 2011 to the current study on the Class of 2012 in the rates at which students are fulfilling potential? What are the longitudinal patterns in the rates at which students are demonstrating and fulfilling AP potential?
3. What is contributing to the differences between and within states and schools? Why have some states achieved relatively parity across racial/ethnic groups in the rates at which students fulfill AP potential, while others demonstrate considerable differences? Why have some states eliminated and/or reversed the typical Black-White potential gap? Differential state policies? Differential funding? Demographic differences? Curricular differences?

4. Are there schools that are successfully closing the AP potential gap in math and science for all students? Which schools are most successfully doing so and what is contributing to this success?
5. Why are students who attend schools that offer AP courses for which they have high AP potential not taking AP? What can be done to address this issue?
6. Why does using PSAT/NMSQT scores increase the likelihood of White students fulfilling high AP potential, but have inconsistent, no or negative effects for Hispanic, Asian and Black students?
7. Why are Black, Hispanic and White males less likely to fulfill high AP potential than their female peers of the same race/ethnicity? What can be done to close this gender gap? Why do Asian males buck this trend?
8. Why did bilingualism decrease White students' chances of fulfilling AP potential, but not non-White students?
9. Why did mother's education have differential effects for different racial/ethnic groups on the likelihood of a student fulfilling AP potential?
10. What other factors are contributing to why students with high AP potential are not engaging in AP?

As state and district leaders design policy, as teachers and principals design their curricular and instructional programs, as counselors advise students on courses of study, as researchers consider how to deliver rigor at scale, and as parents and students advocate for themselves, these are questions to consider and explore in our collective efforts to help students learn and achieve at the highest levels possible.

From the beginning, this study was conceived as the first leg of a larger research journey to better understand and ultimately solve the problem of unfulfilled AP potential. It has developed a more detailed map of the problem by state and subject, and explored the effect of school AP policy and student-level characteristics. At the same time, it has yielded a series of questions both for future research and policy. I hope that these findings help and spur researchers, administrators, policymakers, parents and students to examine what the situation may be in their own schools and take action so that each and every child's unique potential is identified, developed, nurtured, and fulfilled.

APPENDIX A: SUB-SAMPLES AND MATCH RATES, BY RESEARCH QUESTION

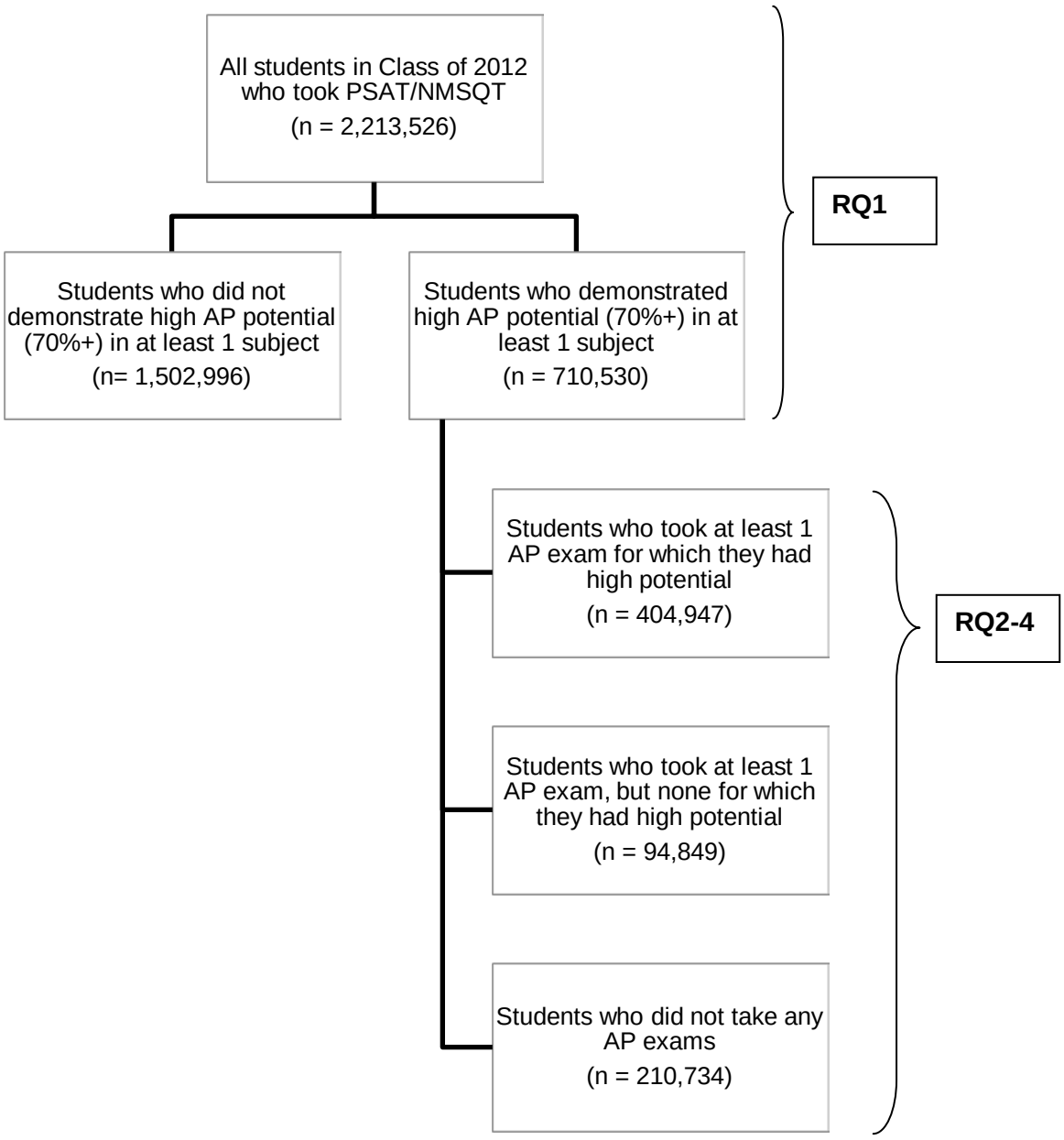

Figure 15. Analytic sub-samples, by research question.

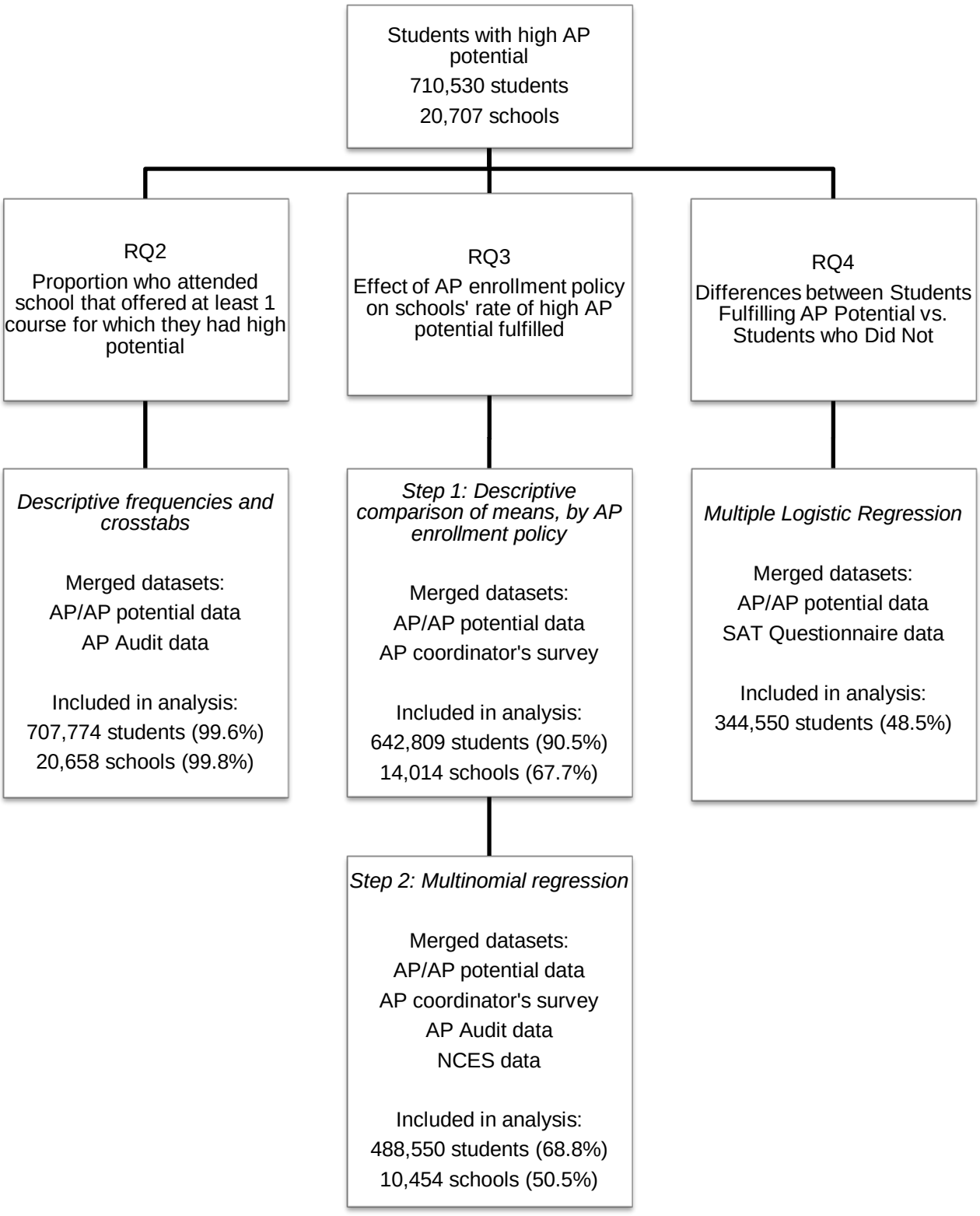

Figure 16. Sub-sample match rates for research questions 2, 3, and 4.

APPENDIX B: STATE AND SUBJECT LEVEL DATA DETAIL, BY RACE/ETHNICITY

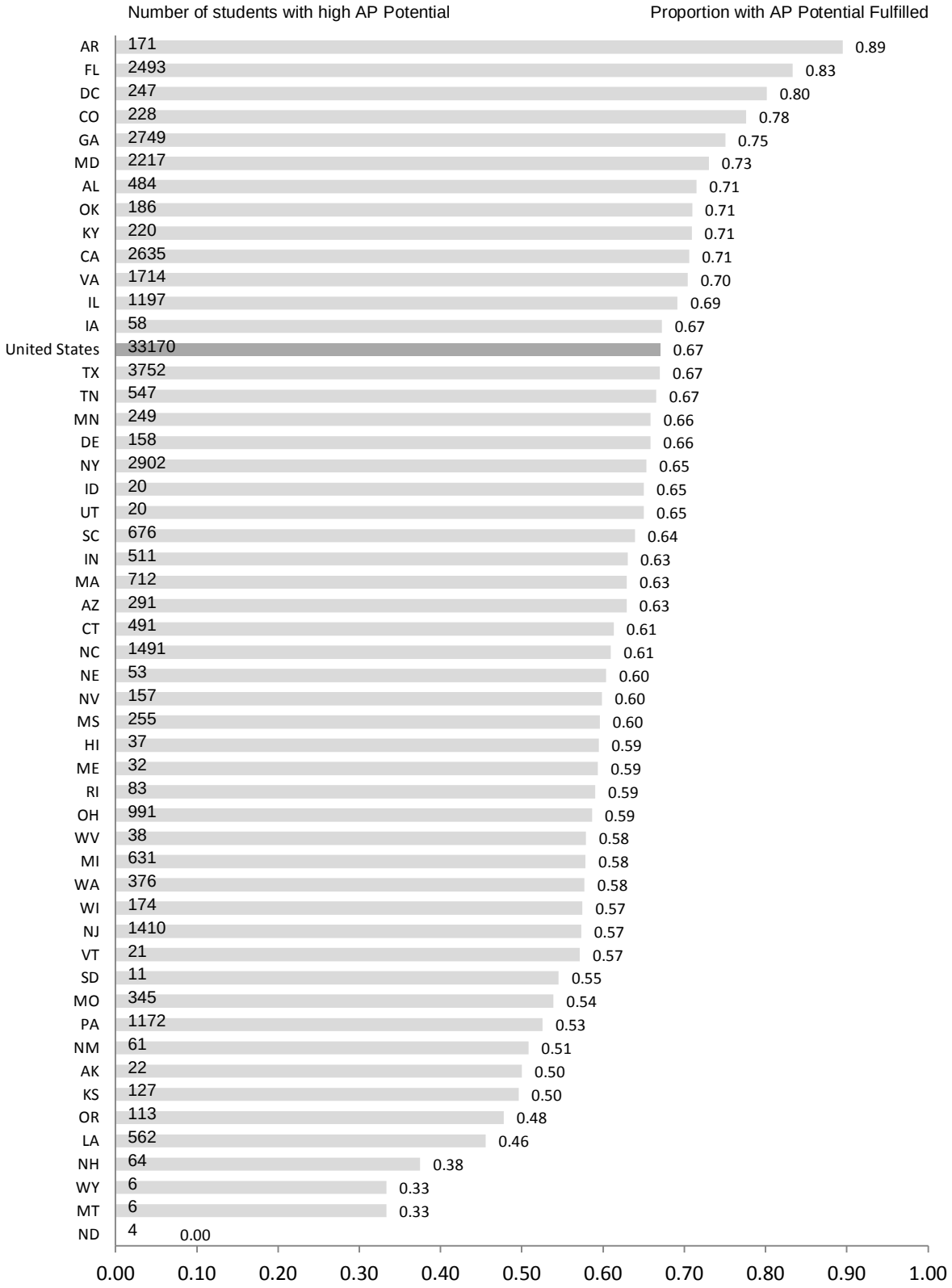

Figure 17. Proportion of Black students fulfilling AP potential, by state.

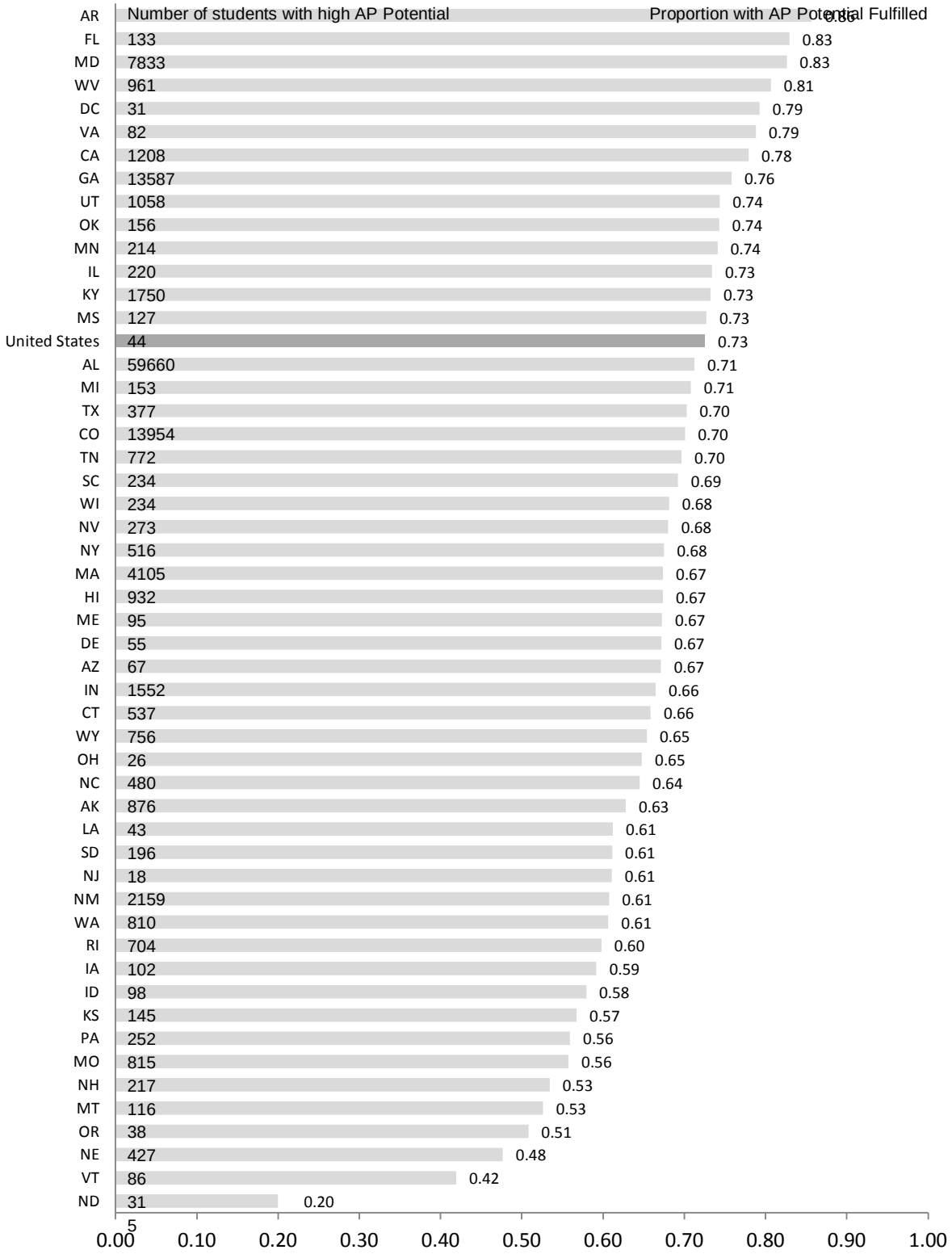

Figure 18. Proportion of Hispanic students fulfilling AP potential, by state.

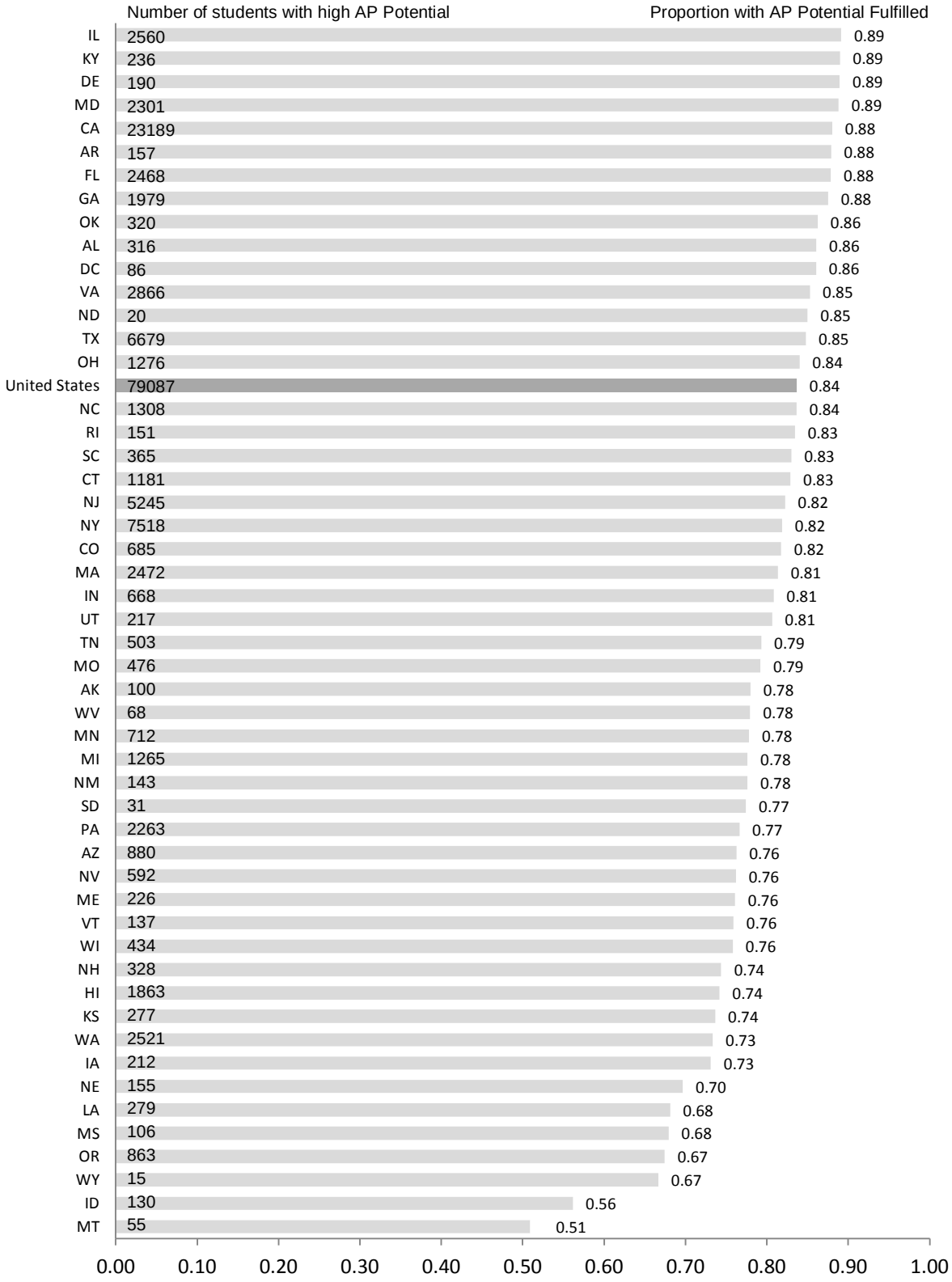

Figure 19. Proportion of Asian students fulfilling AP potential, by state.

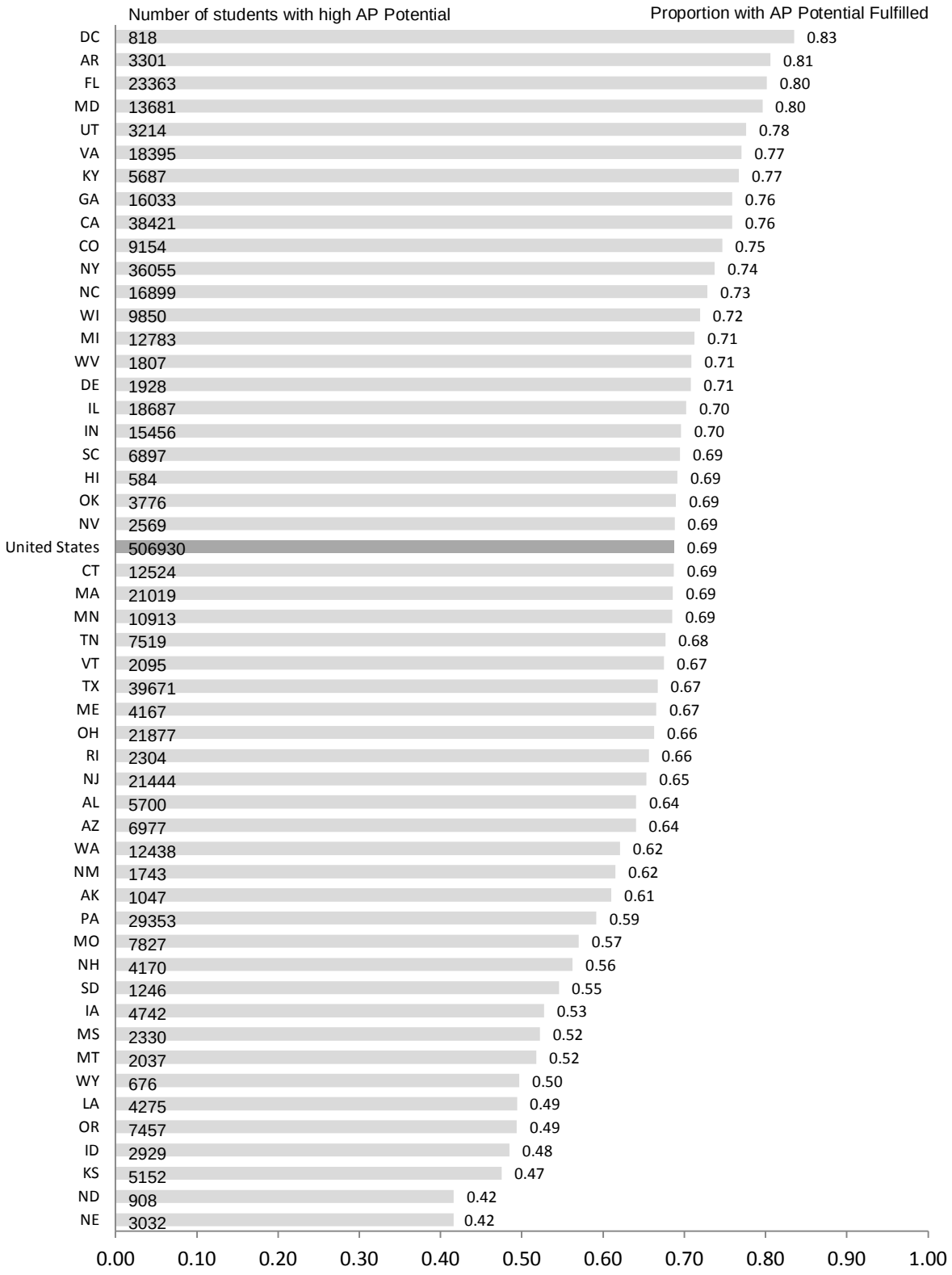

Figure 20. Proportion of White students fulfilling AP potential, by state.

Table 10

Students who took PSAT, Demonstrated High AP Potential, and Fulfilled High AP Potential, by State

	# students who took PSAT/NMSQT					# students with high AP potential					# students who fulfilled high AP potential				
State	Asian	Black	Hisp	White	Total	Asian	Black	Hisp	White	Total	Asian	Black	Hisp	White	Total
AK	311	82	100	1981	2928	100	22	43	1047	1322	78	11	27	639	804
AL	575	7971	700	14657	24761	316	484	153	5700	6836	272	346	109	3653	4493
AR	405	2215	1378	8617	13180	157	171	133	3301	3891	138	153	114	2660	3149
AZ	1551	1210	7485	12828	24845	880	291	1552	6977	10139	671	183	1042	4468	6628
CA	46345	18716	103375	72639	267392	23189	2635	13587	38421	83864	20414	1860	10587	29152	66226
CO	1267	982	3523	16314	23455	685	228	772	9154	11320	560	177	541	6836	8414
CT	2004	4522	5349	25066	39396	1181	491	756	12524	15535	979	301	498	8608	10721
DC	142	3600	492	1026	5772	86	247	82	818	1353	74	198	65	683	1102
DE	397	2216	698	5152	8997	190	158	67	1928	2412	169	104	45	1365	1734
FL	5530	30219	44714	68691	160511	2468	2493	7833	23363	37898	2168	2078	6496	18729	30761
GA	4467	37547	8799	50765	108476	1979	2749	1058	16033	22761	1732	2063	802	12168	17350
HI	6322	162	371	1284	9577	1863	37	95	584	2800	1382	22	64	404	1998
IA	319	175	232	8373	9359	212	58	98	4742	5237	155	39	58	2500	2811
ID	223	58	553	5458	6579	130	20	145	2929	3334	73	13	84	1420	1634
IL	3735	6613	6078	30600	49851	2560	1197	1750	18687	25126	2282	828	1285	13129	18061
IN	1425	7079	3963	50129	65770	668	511	537	15456	17681	540	322	357	10761	12290
KS	626	1069	1357	10307	14198	277	127	252	5152	6004	204	63	143	2447	2938
KY	387	1030	353	11075	13325	236	220	127	5687	6460	210	156	93	4363	4942
LA	517	3720	427	8293	13559	279	562	196	4275	5490	190	256	120	2112	2751
MA	4167	4922	6301	41352	61041	2472	712	932	21019	26251	2011	448	628	14419	18183
MD	4278	22090	5294	32485	69067	2301	2217	961	13681	20105	2044	1619	794	10892	16031
ME	490	395	276	14399	16432	226	32	55	4167	4611	172	19	37	2774	3062
MI	1829	7358	1283	24611	37703	1265	631	377	12783	15752	982	365	267	9110	11108
MN	1956	1301	788	18850	24236	712	249	220	10913	12519	554	164	163	7479	8602
MO	769	2704	674	13652	18800	476	345	217	7827	9168	377	186	121	4463	5285
MS	200	2331	140	5234	8223	106	255	44	2330	2816	72	152	32	1217	1510
MT	113	34	99	4245	4843	55	6	38	2037	2230	28	2	20	1055	1137
NC	2867	19209	6105	43224	76088	1308	1491	876	16899	21464	1094	909	565	12311	15437
ND	35	18	19	1875	2010	20	4	5	908	963	17	0	1	378	405
NE	276	211	314	5989	7031	155	53	86	3032	3415	108	32	41	1262	1488
NH	483	172	259	8778	10070	328	64	116	4170	4824	244	24	62	2346	2746
NJ	8340	11025	12232	46997	84289	5245	1410	2159	21444	31591	4313	808	1319	14008	21238
NM	333	501	8808	5098	17725	143	61	810	1743	3036	111	31	492	1072	1854
NV	2748	2755	8690	10400	27527	592	157	516	2569	4034	451	94	351	1768	2774
NY	15256	31223	37244	82315	185015	7518	2902	4105	36055	53380	6155	1896	2771	26587	39164
OH	1971	9655	1689	42528	59516	1276	991	480	21877	25533	1072	581	311	14502	16987
OK	641	1104	819	7755	11923	320	186	214	3776	5079	276	132	159	2605	3535
OR	2165	1028	4948	23040	34009	863	113	427	7457	9359	582	54	217	3683	4729
PA	4389	13580	5959	66801	96372	2263	1172	815	29353	34591	1734	616	456	17374	20696
RI	337	592	1397	4855	7714	151	83	102	2304	2759	126	49	61	1512	1808
SC	816	12311	1700	22320	39518	365	676	234	6897	8475	303	432	162	4790	5874
SD	63	26	43	2449	2680	31	11	18	1246	1344	24	6	11	680	742
TN	741	2750	536	12739	17287	503	547	234	7519	9038	399	364	163	5088	6161
TX	13329	37862	112270	99414	275792	6679	3752	13954	39671	66377	5662	2513	9807	26471	45853
UT	403	73	507	5250	6554	217	20	156	3214	3729	175	13	116	2495	2866
VA	6072	16901	6799	42090	77503	2866	1714	1208	18395	25467	2444	1207	952	14171	19706
VT	236	84	89	4240	4850	137	21	31	2095	2356	104	12	13	1414	1578
WA	5256	2052	4649	24421	39597	2521	376	704	12438	17029	1849	217	427	7722	10792
WI	860	932	756	17909	21218	434	174	273	9850	11017	329	100	186	7084	7849
WV	101	199	89	4715	5293	68	38	31	1807	2005	53	22	25	1281	1414
WY	32	12	98	1440	1669	15	6	26	676	750	10	2	17	336	375
U.S.	158100	334596	420821	1144725	2213526	79087	33170	59660	506930	710530	66166	22242	43277	348446	499796

Note. Total includes all students, including students who are American Indian/Native, Other, and who did not self-report their race/ethnicity.

Table 11

Percent of Students Demonstrating and Fulfilling High AP Potential, by State

	Percent of Students who with high AP Potential					Percent of students who fulfilled high AP potential				
State	Asian	Black	Hispanic	White	Total	Asian	Black	Hispanic	White	Total
AK	32%	27%	43%	53%	45%	78%	50%	63%	61%	61%
AL	55%	6%	22%	39%	28%	86%	71%	71%	64%	66%
AR	39%	8%	10%	38%	30%	88%	89%	86%	81%	81%
AZ	57%	24%	21%	54%	41%	76%	63%	67%	64%	65%
CA	50%	14%	13%	53%	31%	88%	71%	78%	76%	79%
CO	54%	23%	22%	56%	48%	82%	78%	70%	75%	74%
CT	59%	11%	14%	50%	39%	83%	61%	66%	69%	69%
DC	61%	7%	17%	80%	23%	86%	80%	79%	83%	81%
DE	48%	7%	10%	37%	27%	89%	66%	67%	71%	72%
FL	45%	8%	18%	34%	24%	88%	83%	83%	80%	81%
GA	44%	7%	12%	32%	21%	88%	75%	76%	76%	76%
HI	29%	23%	26%	45%	29%	74%	59%	67%	69%	71%
IA	66%	33%	42%	57%	56%	73%	67%	59%	53%	54%
ID	58%	34%	26%	54%	51%	56%	65%	58%	48%	49%
IL	69%	18%	29%	61%	50%	89%	69%	73%	70%	72%
IN	47%	7%	14%	31%	27%	81%	63%	66%	70%	70%
KS	44%	12%	19%	50%	42%	74%	50%	57%	47%	49%
KY	61%	21%	36%	51%	48%	89%	71%	73%	77%	77%
LA	54%	15%	46%	52%	40%	68%	46%	61%	49%	50%
MA	59%	14%	15%	51%	43%	81%	63%	67%	69%	69%
MD	54%	10%	18%	42%	29%	89%	73%	83%	80%	80%
ME	46%	8%	20%	29%	28%	76%	59%	67%	67%	66%
MI	69%	9%	29%	52%	42%	78%	58%	71%	71%	71%
MN	36%	19%	28%	58%	52%	78%	66%	74%	69%	69%
MO	62%	13%	32%	57%	49%	79%	54%	56%	57%	58%
MS	53%	11%	31%	45%	34%	68%	60%	73%	52%	54%
MT	49%	18%	38%	48%	46%	51%	33%	53%	52%	51%
NC	46%	8%	14%	39%	28%	84%	61%	64%	73%	72%
ND	57%	22%	26%	48%	48%	85%	0%	20%	42%	42%
NE	56%	25%	27%	51%	49%	70%	60%	48%	42%	44%
NH	68%	37%	45%	48%	48%	74%	38%	53%	56%	57%
NJ	63%	13%	18%	46%	37%	82%	57%	61%	65%	67%
NM	43%	12%	9%	34%	17%	78%	51%	61%	62%	61%
NV	22%	6%	6%	25%	15%	76%	60%	68%	69%	69%
NY	49%	9%	11%	44%	29%	82%	65%	68%	74%	73%
OH	65%	10%	28%	51%	43%	84%	59%	65%	66%	67%
OK	50%	17%	26%	49%	43%	86%	71%	74%	69%	70%
OR	40%	11%	9%	32%	28%	67%	48%	51%	49%	51%
PA	52%	9%	14%	44%	36%	77%	53%	56%	59%	60%
RI	45%	14%	7%	47%	36%	83%	59%	60%	66%	66%
SC	45%	5%	14%	31%	21%	83%	64%	69%	69%	69%
SD	49%	42%	42%	51%	50%	77%	55%	61%	55%	55%
TN	68%	20%	44%	59%	52%	79%	67%	70%	68%	68%
TX	50%	10%	12%	40%	24%	85%	67%	70%	67%	69%
UT	54%	27%	31%	61%	57%	81%	65%	74%	78%	77%
VA	47%	10%	18%	44%	33%	85%	70%	79%	77%	77%
VT	58%	25%	35%	49%	49%	76%	57%	42%	67%	67%
WA	48%	18%	15%	51%	43%	73%	58%	61%	62%	63%
WI	50%	19%	36%	55%	52%	76%	57%	68%	72%	71%
WV	67%	19%	35%	38%	38%	78%	58%	81%	71%	71%
WY	47%	50%	27%	47%	45%	67%	33%	65%	50%	50%
United States	50%	10%	14%	44%	32%	84%	67%	73%	69%	70%

Note. Total includes all students, including students who are American Indian/Native, Other, and who did not self-report their race/ethnicity.

Table 12

Students Demonstrating and Fulfilling High AP potential, by Subject

	# Students demonstrating AP Potential					# Students fulfilling AP potential					% Students fulfilling AP potential				
Subject	Asian	Black	Hispanic	White	Total	Asian	Black	Hispanic	White	Total	Asian	Black	Hispanic	White	Total
Humanities															
English Language	61452	28665	48756	442132	608645	28014	9798	20116	142807	209414	46%	34%	41%	32%	34%
English Literature	44701	14706	26692	292878	396529	20198	5542	11698	110521	154236	45%	38%	44%	38%	39%
Art History	38996	11088	20944	243619	329108	1438	229	823	5743	8699	4%	2%	4%	2%	3%
Music Theory	43944	7502	16918	211874	291867	1392	159	424	4616	6863	3%	2%	3%	2%	2%
Math															
Calculus AB	44810	4693	12694	153042	223720	19332	1849	5376	61683	91351	43%	39%	42%	40%	41%
Calculus BC	58858	9796	24255	248525	355240	19808	1238	3748	37889	64997	34%	13%	15%	15%	18%
Statistics	45041	8075	18479	222274	306362	13506	1342	3189	38605	58692	30%	17%	17%	17%	19%
Science															
Biology	40994	6541	15271	192466	266091	17068	1496	3590	40088	64828	42%	23%	24%	21%	24%
Chemistry	35402	4697	11476	153338	213652	14335	917	2365	31248	50711	40%	20%	21%	20%	24%
Physics B	35402	4697	11476	153338	213652	7579	582	1783	20560	31712	21%	12%	16%	13%	15%
Physics Mechanics	31688	3740	9339	130155	182398	5913	319	947	12889	20857	19%	9%	10%	10%	11%
Physics Elect/Magnetism	22448	1790	4856	75377	109057	3051	115	342	5030	8858	14%	6%	7%	7%	8%
Environmental Science	48984	9901	22096	253248	348463	5705	916	2485	23137	33666	12%	9%	11%	9%	10%
Computer Science A	39095	5841	13869	178668	247571	4206	249	594	7049	12577	11%	4%	4%	4%	5%
Social Sciences															
US History	53115	13935	28213	311738	424754	27363	5478	12810	123553	176143	52%	39%	45%	40%	41%
European History	58968	17764	35079	362189	494786	9200	1525	3998	40359	57621	16%	9%	11%	11%	12%
World History	59969	16029	33897	342773	472356	13820	3277	7550	48373	76136	23%	20%	22%	14%	16%
US Government	39607	7217	15805	202806	276859	13013	1825	5212	51922	74946	33%	25%	33%	26%	27%
Comparative Government	38351	6751	14858	193574	264448	1265	168	402	5227	7389	3%	2%	3%	3%	3%
Macroeconomics	33493	4195	10342	141544	197660	8015	581	2049	18470	30270	24%	14%	20%	13%	15%
Microeconomics	43061	7296	16842	207432	286307	6054	471	1303	15059	23766	14%	6%	8%	7%	8%
Psychology	69858	26623	50064	457986	631854	15431	3942	7759	68236	99173	22%	15%	15%	15%	16%
Human Geography	57474	16755	33330	349328	476894	3615	1041	2332	16314	24255	6%	6%	7%	5%	5%

Note. "Total" includes all students, including students who are American Indian/Native, Other, and who did not self-report their race/ethnicity.

Table 13

Students with Unfulfilled High AP Potential who Attended Schools that Offered at Least One Course for which They had Potential, by State

	# students with unfulfilled high AP potential					# students with unfulfilled AP potential who attended school that offered at least 1 course for which they had high potential					% who attended schools that offered at least one AP course for which they had high potential				
State	Asian	Black	Hisp	White	Total	Asian	Black	Hisp	White	Total	Asian	Black	Hisp	White	Total
AK	22	11	16	403	513	12	9	8	191	255	55%	82%	50%	47%	50%
AL	44	138	43	2010	2305	29	83	26	976	1147	66%	60%	60%	49%	50%
AR	18	18	19	597	693	14	12	13	317	385	78%	67%	68%	53%	56%
AZ	207	107	509	2475	3470	154	77	370	1824	2548	74%	72%	73%	74%	73%
CA	2775	775	3000	9269	17638	2143	567	2179	6679	12911	77%	73%	73%	72%	73%
CO	123	49	231	2277	2857	103	38	151	1553	1978	84%	78%	65%	68%	69%
CT	201	190	258	3898	4791	172	144	188	3213	3904	86%	76%	73%	82%	81%
DC	11	49	17	134	249	4	30	5	60	112	36%	61%	29%	45%	45%
DE	19	54	22	555	668	13	32	13	385	456	68%	59%	59%	69%	68%
FL	296	412	1330	4537	7017	228	343	1176	3454	5569	77%	83%	88%	76%	79%
GA	246	686	256	3781	5318	194	572	223	3000	4292	79%	83%	87%	79%	81%
HI	478	15	30	176	792	309	9	20	122	532	65%	60%	67%	69%	67%
IA	57	19	39	2224	2404	29	12	17	773	858	51%	63%	44%	35%	36%
ID	57	7	60	1474	1660	20	0	26	627	700	35%	0%	43%	43%	42%
IL	277	368	465	5483	6978	212	257	339	3334	4407	77%	70%	73%	61%	63%
IN	123	189	180	4565	5248	101	140	138	3229	3760	82%	74%	77%	71%	72%
KS	72	63	108	2663	3017	38	38	56	1027	1211	53%	60%	52%	39%	40%
KY	26	63	33	1259	1448	19	49	25	878	1022	73%	78%	76%	70%	71%
LA	89	306	75	2144	2717	59	176	52	1222	1570	66%	58%	69%	57%	58%
MA	461	264	304	6574	8039	341	180	202	4759	5775	74%	68%	66%	72%	72%
MD	256	595	162	2734	4004	217	506	138	2203	3276	85%	85%	85%	81%	82%
ME	54	13	18	1385	1541	43	13	13	995	1122	80%	100%	72%	72%	73%
MI	283	265	108	3556	4513	117	174	65	1863	2377	41%	66%	60%	52%	53%
MN	154	84	57	3318	3792	91	47	24	1547	1798	59%	56%	42%	47%	47%
MO	97	158	92	3309	3820	53	98	51	1706	2003	55%	62%	55%	52%	52%
MS	33	103	12	1093	1284	20	66	5	620	728	61%	64%	42%	57%	57%
MT	27	4	17	960	1067	9	1	6	373	407	33%	25%	35%	39%	38%
NC	212	580	309	4477	5902	166	437	225	3199	4248	78%	75%	73%	71%	72%
ND	3	4	4	520	548	0	2	1	124	134	0%	50%	25%	24%	24%
NE	47	21	43	1739	1893	27	19	26	784	877	57%	90%	60%	45%	46%
NH	83	40	54	1810	2063	50	16	20	1108	1234	60%	40%	37%	61%	60%
NJ	930	601	840	7398	10308	721	421	588	6023	8169	78%	70%	70%	81%	79%
NM	31	30	318	645	1155	19	20	201	347	673	61%	67%	63%	54%	58%
NV	141	63	164	794	1250	108	50	138	639	1003	77%	79%	84%	80%	80%
NY	1363	1005	1332	9401	14139	926	517	724	5174	7895	68%	51%	54%	55%	56%
OH	203	408	167	7257	8416	139	248	104	4259	4994	68%	61%	62%	59%	59%
OK	43	52	53	1111	1474	29	36	34	682	912	67%	69%	64%	61%	62%
OR	280	59	210	3724	4575	114	29	105	1790	2188	41%	49%	50%	48%	48%
PA	528	555	356	11877	13780	391	380	250	8149	9477	74%	68%	70%	69%	69%
RI	25	33	41	786	943	17	19	27	535	623	68%	58%	66%	68%	66%
SC	62	242	70	2063	2551	45	159	48	1264	1589	73%	66%	69%	61%	62%
SD	7	5	7	562	598	2	5	6	233	253	29%	100%	86%	41%	42%
TN	104	183	70	2402	2843	70	129	41	1441	1737	67%	70%	59%	60%	61%
TX	1017	1239	4147	13200	20524	796	1058	3219	9938	15700	78%	85%	78%	75%	76%
UT	42	7	40	712	856	25	5	24	422	514	60%	71%	60%	59%	60%
VA	417	503	252	4080	5592	249	342	170	2801	3781	60%	68%	67%	69%	68%
VT	33	8	18	672	766	24	6	9	372	432	73%	75%	50%	55%	56%
WA	668	159	273	4639	6141	348	96	146	2748	3568	52%	60%	53%	59%	58%
WI	105	74	86	2714	3110	41	39	45	1470	1660	39%	53%	52%	54%	53%
WV	12	16	6	502	561	10	13	2	348	390	83%	81%	33%	69%	70%
WY	5	4	9	332	366	1	2	5	152	170	20%	50%	56%	46%	46%
U.S.	12867	10896	16330	156270	208197	9062	7721	11687	100932	137324	70%	71%	72%	65%	66%

Note. "Total" also includes students who are American Indian/Native, Other, and who did not self-report their race/ethnicity.

Table 14

Students with Unfulfilled AP Potential who Attended Schools that Offered at Least One AP Course For Which They had Potential, by Subject

	# students with unfulfilled AP potential					# students with unfulfilled AP potential who attended school that offered at least 1 course for which they had potential					% who attended schools that offered at least one AP course for which they had potential					Largest diff b/t groups
Subject	Asian	Black	Hisp	White	Total	Asian	Black	Hisp	White	Total	Asian	Black	Hisp	White	Total	
World History	6910	3893	6838	80348	103503	2192	1465	2747	19304	27258	32%	38%	40%	24%	26%	16%
Macroeconomics	2273	593	1171	19598	25020	667	166	429	4133	5747	29%	28%	37%	21%	23%	16%
Physics: Mechanics	2038	510	1012	17314	22097	743	160	304	3749	5283	36%	31%	30%	22%	24%	15%
English Language	8054	9209	12786	129466	169366	4464	5735	8311	65180	89030	55%	62%	65%	50%	53%	15%
U.S. Government	3057	1257	2160	33976	42780	1443	605	1155	13422	17596	47%	48%	53%	40%	41%	14%
Calculus BC	7678	2213	4632	52280	70345	4074	1186	2375	21598	30939	53%	54%	51%	41%	44%	12%
Statistics	3902	1441	2724	39290	50067	2135	767	1412	16791	22412	55%	53%	52%	43%	45%	12%
Chemistry	2501	707	1350	22129	28236	1412	390	722	9909	13200	56%	55%	53%	45%	47%	12%
Physics B	2501	707	1350	22129	28236	898	268	538	6331	8538	36%	38%	40%	29%	30%	11%
Env Science	4614	1955	3528	48575	61995	1600	708	1256	12267	16887	35%	36%	36%	25%	27%	11%
Psychology	9492	7755	12186	129871	168466	3819	3430	4943	43860	59382	40%	44%	41%	34%	35%	10%
Biology	3265	1104	2066	31347	39937	1839	663	1225	15554	20399	56%	60%	59%	50%	51%	10%
Computer Sci A	2988	950	1789	28051	35712	962	293	508	6178	8417	32%	31%	28%	22%	24%	10%
U.S. History	5399	3082	5128	67792	86038	3471	2061	3527	40041	51924	64%	67%	69%	59%	60%	10%
Physics Elec / Mag	1166	204	406	7707	10091	257	37	79	991	1471	22%	18%	19%	13%	15%	9%
English Literature	4426	3667	5327	67535	85949	2805	2543	3769	41903	54196	63%	69%	71%	62%	63%	9%
Human Geography	6309	4009	6542	81923	104363	952	817	1190	9677	13411	15%	20%	18%	12%	13%	9%
Calculus AB	4673	782	1787	24229	33146	3212	561	1281	15312	21466	69%	72%	72%	63%	65%	9%
Art History	3413	2550	3815	51107	64637	663	517	752	6637	9191	19%	20%	20%	13%	14%	7%
Music Theory	3667	1353	2430	36607	46452	990	370	663	7657	10244	27%	27%	27%	21%	22%	6%
European History	6660	4363	7066	87075	111070	2543	1725	2513	29497	38328	38%	40%	36%	34%	35%	6%
Microeconomics	3599	1263	2373	35256	44933	784	279	478	5832	7842	22%	22%	20%	17%	17%	6%
Comparative Govt	2877	1154	1975	31622	39804	341	117	244	2404	3295	12%	10%	12%	8%	8%	5%

Note. "Total" includes all students, including students who are American Indian/Native, Other, and who did not self-report their race/ethnicity.

APPENDIX C: EFFECTS OF SCHOOL AP ENROLLMENT POLICY, BY RACE/ETHNICITY

Table 15

Multinomial Regression: Effect of School AP Enrollment Policy on School Percentage of Black Students' AP Potential Fulfilled (APPF)

Summary of Variables with Statistically Significant Exp(B)Odds Ratios

Comparison Category	Reference Category				
	Category 1 (0% APPF)	Category 2 (.0001-25% APPF)	Category 3 (25.0001-50% APPF)	Category 4 (50.0001-75% APPF)	Category 5 (75.0001-99.9999% APPF)
Category 2: .0001-25% APPF	# APP Students (1.008)*** HS enrollment (1.001)*** % FRL (.980)** % Minority (1.029)***				
Category 3: 25.0001-50% APPF	# APP Students (1.007)*** # AP courses (1.069)*** HS enrollment (1.0003)** % minority (1.015)***	# AP courses (1.110)*** HS enrollment (.9996)* % FRL (1.021)** % minority (.987)*			
Category 4: 50.0001-75% APPF	# APP Students (1.008)*** # AP courses (1.177)*** HS enrollment (1.0002)* % FRL (.992)* % minority (1.034)*** Uses PSAT (1.850)**	# AP courses (1.223)*** HS Enrollment (.9995)**	# AP courses(1.101)*** % FRL (.992)* % Minority (1.019)***		
Category 5: 75.0001-99.9999% APPF	# APP Students (1.008)*** # AP courses (1.272)*** % FRL (.989)* % minority (1.052)*** Uses PSAT (1.831)**	# AP courses (1.321)*** HS Enrollment (.999)** % minority (1.023)***	# AP courses (1.190)*** % FRL (.989)* % Minority (1.036)***	# AP courses(1.080)*** % minority (1.017)*	
Category 6: 100% APPF	# AP courses (1.140)*** % minority (1.009)* Uses PSAT (1.437)* Uses student/parent (1.304)*	# APP Students (.992)*** # AP courses (1.185)*** HS Enrollment (.999)*** % FRL (1.022)** % minority (.981)***	# APP Students (.992)*** # AP courses(1.067)*** HS Enrollment (.9997)*** % minority (.994)*** Suburb (.784)*	# APP Students (.992)*** # AP courses (.969)* HS Enrollment (.9998)** % FRL (1.010)** % minority (.975)***	# APP Students (.991)*** # AP courses (.897)* % FRL (1.013)** % minority (.959)*** Town (2.791)*

* p < .05; ** p < .01; *** p < .001

Classification Table

Observed	Predicted						
	1	2	3	4	5	6	Percent Correct
1	92	0	8	8	4	654	12.0%
2	5	0	3	8	2	83	0.0%
3	19	0	22	53	28	608	3.0%
4	3	0	15	90	77	557	12.1%
5	0	0	5	71	104	322	20.7%
6	60	0	13	65	68	1959	90.5%
Overall Percentage	3.6%	0.0%	1.3%	5.9%	5.7%	83.6%	45.3%

Table 16

Multinomial Regression: Effect of School AP Enrollment Policy on School Percentage of Hispanic Students' AP Potential Fulfilled (APPF)

Summary of Variables with Statistically Significant Exp(B) Odds Ratios

	Reference Category				
Comparison Category	Category 1 (0% APPF)	Category 2 (.0001-25% APPF)	Category 3 (25.0001-50% APPF)	Category 4 (50.0001-75% APPF)	Category 5 (75.0001-99.9999% APPF)
Category 2: .0001-25% APPF	# APP Students (1.013)*** HS enrollment (1.001)* % FRL (.984)** % Minority (1.034)*** City (.469)*				
Category 3: 25.0001-50% APPF	# APP Students (1.010)*** # AP courses (1.100)*** % FRL (.990)* % minority (1.024)***	# AP courses (1.082)*			
Category 4: 50.0001-75% APPF	# APP Students (1.014)*** # AP courses (1.183)*** HS enrollment (1.0004)*** % FRL (.989)** % minority (1.043)*** Uses PSAT (1.581)*	# AP courses (1.163)***	# APP Students (1.004)*** # AP courses (1.075)*** HS enrollment (1.0002)* % Minority (1.019)***		
Category 5: 75.0001-99.9999% APPF	# APP Students (1.012)*** # AP courses (1.322)*** HS enrollment (1.001)*** % FRL (.988)** % minority (1.059)***	# AP courses (1.300)*** % minority (1.024)***	# APP Students (1.003)* # AP courses (1.202)*** HS enrollment (1.0004)*** % Minority (1.034)***	# APP Students (.998)* # AP courses (1.117)*** HS enrollment (1.0002) % minority (1.015)*** Uses PSAT (.713)*	
Category 6: 100% APPF	# AP courses (1.250)*** % minority (1.012)***	# APP Students (.986)*** # AP courses (1.229)*** HS Enrollment (.999)** % minority (.979)***	# APP Students (.988)*** # AP courses (1.137)*** HS Enrollment (.9997)** % FRL (1.006)* % minority (.989)***	# APP Students (.984)*** # AP courses (1.057)* HS Enrollment (.9995)** % FRL (1.007)** % minority (.971)***	# APP Students (.986)*** # AP courses (.946)* HS Enrollment (.999)** % FRL (1.008)** % minority (.956)***

* p < .05; ** p < .01; *** p < .001

Classification Table

Observed	Predicted						
	1	2	3	4	5	6	Percent Correct
1	178	0	7	9	12	539	23.9%
2	5	0	1	14	8	60	0.0%
3	40	0	4	59	73	513	0.6%
4	8	0	4	137	330	573	13.0%
5	3	0	0	102	594	396	54.2%
6	107	0	1	63	220	2022	83.8%
Overall Percentage	5.6%	0.0%	0.3%	6.3%	20.3%	67.5%	48.3%

Table 17

Multinomial Regression: Effect of School AP Enrollment Policy on School Percentage of Asian Students' AP Potential Fulfilled (APPF)

Summary of Variables with Statistically Significant Exp(B) Odds Ratios

	Reference Category				
Comparison Category	Category 1 (0% APPF)	Category 2 (.0001-25% APPF)	Category 3 (25.0001-50% APPF)	Category 4 (50.0001-75% APPF)	Category 5 (75.0001-99.9999% APPF)
Category 2: .0001-25% APPF	# APP Students (1.028)*** # AP courses (.922)* % FRL (.981)* % Minority (1.037)***				
Category 3: 25.0001-50% APPF	# APP Students (1.014)*** # AP courses (1.096)*** % FRL (.990)* % minority (1.016)*** City (1.658)** Town (1.472)* Uses PSAT (1.703)**	# APP Students (.987)** # AP courses (1.189)*** % minority (.979)**			
Category 4: 50.0001-75% APPF	# APP Students (1.023)*** # AP courses (1.141)*** % FRL (.981)*** % minority (1.035)*** Suburb (1.557)**	# AP courses (1.238)***	# APP Students(1.008)*** # AP courses (1.041)* % FRL (.991)* % Minority (1.018)***		
Category 5: 75.0001-99.9999% APPF	# APP Students (1.033)*** # AP courses (1.239)*** % FRL (.969)*** % minority (1.059)*** City (1.554)* Suburb (1.941)***	# AP courses (1.344)*** % minority (1.021)**	# APP Students(1.018)*** # AP courses (1.130)*** % FRL (.979)*** % Minority (1.043)*** Suburb (1.485)* Uses PSAT (.494)***	# APP Students(1.010)*** # AP courses (1.086)*** % FRL (.988)*** % minority (1.024)*** Uses PSAT (.670)*	
Category 6: 100% APPF	# APP Students (1.008)** # AP courses (1.260)*** % minority (1.012)*** Suburb (1.378)**	# APP Students (.981)*** # AP courses (1.367)*** % minority (.976)***	# APP Students (.994)** # AP courses (1.150)*** City (.701)* Uses PSAT (.593)**	# APP Students (.986)*** # AP courses (1.105)*** HS Enrollment (.9997)** % FRL (1.016)*** % minority (.979)***	# APP Students (.976)*** HS Enrollment (.9998)** % FRL (1.028)*** % minority (.956)*** City (.748)* Suburb (.710)**

* p < .05; ** p < .01; *** p < .001

Classification Table

Observed	Predicted						
	1	2	3	4	5	6	Percent Correct
1	194	0	0	0	7	626	23.5%
2	3	0	0	0	8	44	0.0%
3	21	0	0	0	35	473	0.0%
4	5	0	0	0	127	513	0.0%
5	1	0	0	0	821	595	57.9%
6	120	0	0	0	269	3324	89.5%
Overall Percentage	4.8%	0.0%	0.0%	0.0%	17.6%	77.6%	60.4%

Table 18

Multinomial Regression: Effect of School AP Enrollment Policy on School Percentage of White Students' AP Potential Fulfilled (APPF)

Summary of Variables with Statistically Significant Exp(B)Odds Ratios

	Reference Category				
Comparison Category	Category 1 (0% APPF)	Category 2 (.0001-25% APPF)	Category 3 (25.0001-50% APPF)	Category 4 (50.0001-75% APPF)	Category 5 (75.0001-99.9999% APPF)
Category 2: .0001-25% APPF	# APP Students (1.096)*** % Minority (.983)***				
Category 3: 25.0001-50% APPF	# APP Students (1.095)*** # AP courses (1.286)*** HS enrollment (.9996)* % minority (.992)** Uses PSAT (1.728)** City (.612)*	# AP courses (1.315)*** HS enrollment (.9996)** % minority (1.008)*			
Category 4: 50.0001-75% APPF	# APP Students (1.100)*** # AP courses (1.533)*** HS enrollment (.999)*** % minority (.984)*** Uses PSAT (1.988)*** Uses stud/par (1.336)* City (.469)***	# AP courses (1.567)*** HS enrollment (.999)*** Uses PSAT (1.536)* Uses stud/par (1.321)*	# APP Students (1.004)** # AP courses (1.192)*** % Minority (.992)*** City (.766)*		
Category 5: 75.0001-99.9999% APPF	# APP Students (1.096)*** # AP courses (1.784)*** HS enrollment (.999)*** % minority (.979)*** Uses PSAT (2.484)*** Uses stud/par (1.617)*	# AP courses (1.824)*** HS enrollment (.999)*** Uses PSAT (1.919)** Uses stud/par (1.598)**	# AP courses (1.387)*** HS enrollment (.9997)*** % Minority (.987)*** Uses PSAT (1.437)** Uses stud/par (1.298)*	# APP Students (.997)*** # AP courses (1.164)*** HS enrollment (.9998)** % minority (.995)** Uses PSAT (1.250)* Uses stud/par (1.210)* City (1.516)***	
Category 6: 100% APPF	# APP Students (1.024)** # AP courses (1.679)*** HS enrollment (.999)*** % FRL (1.009)* % minority (1.006)* Uses PSAT (1.480)* Uses stud/par (1.359)* City (.592)* Town (.705)*	# APP Students (.934)*** # AP courses (1.717)*** HS enrollment (.999)*** % FRL (1.010)* % minority (1.023)*** Town (.583)**	# APP Students (.935)*** # AP courses (1.306)*** HS enrollment (.9998)* % FRL (1.009)** % minority (1.015)*** Town (.642)***	# APP Students (.931)*** # AP courses (1.096)*** % FRL (1.012)*** % minority (1.023)*** Uses PSAT (.745)* Town (.635)***	# APP Students (.934)*** # AP courses (.941)*** % FRL (1.010)*** % minority (1.028)*** Town (.552)*** Uses PSAT (.596)***

* p < .05; ** p < .01; *** p < .001

Table 18 (continued)

Classification Table							
Observed	Predicted						
	1	2	3	4	5	6	Percent Correct
1	271	15	27	113	13	118	48.7%
2	69	27	40	199	24	27	7.0%
3	127	13	48	606	202	164	4.1%
4	90	8	42	1240	1348	225	42.0%
5	19	0	26	869	2565	134	71.0%
6	138	0	9	268	238	569	46.6%
Overall Percentage	7.2%	0.6%	1.9%	33.3%	44.4%	12.5%	47.7%

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