MONTGOMERY
COUNTY PUBLIC
SCHOOLS

Grade 9 Indicators Influencing High School Graduation and College Readiness in Montgomery County Public High Schools

Office of Shared Accountability

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Executive Summary

To prepare our students for success in the global economy, it is imperative that they leave high school ready for college and career. Because research has shown that ninth grade is the make or break year for completing high school, educators across the country are focusing on what it takes to help Grade 9 students engage so they can experience academic success early in high school. Critical to this endeavor is an understanding of which Grade 9 behavioral and academic factors are related to on-time graduation and college and career readiness. The Montgomery County Public Schools (MCPS) Office of Shared Accountability (OSA) conducted a study to examine Grade 9 factors that influenced high school graduation and college readiness, as measured by the MCPS Seven Keys to College Readiness (Seven Keys). The Seven Keys is an MCPS initiative on college readiness used to measure the attainment of knowledge and skills necessary for college and career readiness (Von Secker, 2009). The following are the seven keys to college readiness:

1. Advanced Reading in Grades K–2
   - Kindergarten: Reading at text level 6 or higher
   - Grade 2: TN/2 Reading at 70th NP or higher
2. Advanced Reading MSA in Grades 3–8
3. Advanced Math in Grade 5
4. Algebra 1 by Grade 8 with a C or higher
5. Algebra 2 by Grade 11 with a C or higher
6. AP exam score of 3 or higher or IB exam score of 4 or higher
7. SAT combined score of 1650 or higher or ACT composite score of 24 or higher

The study participants included first-time Grade 9 students in 2004–2005 who had complete transcript data (N = 9,162). Grade 9 factors in this analysis were grouped into two categories: behavioral and academic. The behavioral factors included attendance, mobility, and suspension. The academic factors included on track for Grade 10 promotion, Grade Point Average (GPA), academic ineligibility for extracurricular activities, number of Grade 9 semester courses failed, and successful completion of Algebra 1 with a C or higher by Grade 8. This study will examine keys 5, 6, and 7 as the outcome variables.

This study measured the relationship between the academic and behavioral Grade 9 factors and the following four outcomes:
- On-time graduation
- Successful completion of Algebra 2 with a C or higher by Grade 11—Key 5 on the MCPS Seven Keys trajectory
- Attainment of an Advanced Placement (AP) exam score of 3 or higher or an International Baccalaureate (IB) exam score of 4 or higher by the end of Grade 12—Key 6 on the Seven Keys trajectory
- Attainment of a Scholastic Aptitude Test (SAT) score of 1650 or higher or an American College Testing (ACT) score of 24 or higher by the end of Grade 12—Key 7 on the Seven Keys trajectory

The following research questions were addressed in this study:

1. What are the on-time graduation rates for students with different Grade 9 behavioral and academic characteristics?
2. What are the college and career readiness rates on MCPS' three high school level keys to college readiness for students with different behavioral and academic characteristics?
3. Which of the above factors are significantly related to graduating from high school four years later after taking into account the demographic and prior achievement variables?
4. Which of the above factors are significantly related to college readiness keys after taking into account the demographic and prior achievement variables?

To analyze these questions, a set of two-way contingency table analyses using crosstabs were conducted to display the relationship between outcome variables and Grade 9 characteristics. Second, a set of logistic regression models were run for each of the outcomes after controlling for demographic and academic achievement during Grade 8.

Summary of Key Findings

On-Time Graduation

- The descriptive analysis revealed that on-time graduation was higher for students who were on track for Grade 10 promotion, had a Grade 9 GPA of 2.5 or higher, failed one or fewer semester courses, were absent fewer than eight days, were never ineligible during Grade 9, passed Algebra 1 with a C or higher by Grade 8, were never suspended or suspended prior to Grade 9, and never moved between schools during middle school. However, students with this profile did not always meet the college readiness outcomes.

- The more rigorous logistic regression analysis confirmed that the most important factors that influenced on-time graduation were: Grade 9 GPA, being on track for Grade 10 promotion, and passing Algebra 1 with a C or higher by Grade 8. These factors increased the likelihood of graduating on time. Being eligible for special education services decreased the odds of graduating on time. Other factors that were statistically significant but had a small or negligible effect were: Free and Reduced-price Meals System (FARMS) status, suspension, number of days absent during Grade 9, and school mobility. These factors decreased the likelihood of graduating on time.

College Readiness Indicators

- Descriptive analysis revealed that college readiness outcomes were higher for Grade 9 students who were on track for Grade 10 promotion, absent fewer than eight days, never ineligible during Grade 9, had a Grade 9 GPA of 3.5 or higher, had failed no semester courses, and passed Algebra 1 with a C or higher by Grade 8.

- The more rigorous logistic regression analyses confirmed that the most important factors that increased the likelihood of attaining Keys 5, 6, and 7 were: Grade 9 GPA and passing Algebra 1 with a C or higher by Grade 8. Students who were chronically ineligible three

or four marking periods or students eligible for special education services during Grade 9 were significantly less likely to attain a C or higher on Algebra 2 by Grade 11. Students eligible for special education services during Grade 9 also were significantly less likely to attain a 3 or higher on an AP exam or 4 or higher on an IB exam.

- The likelihood of attaining a C or higher on Algebra 2 by Grade 11 and of attaining a 1650 on the SAT or 24 on the ACT decreased for the Hispanic subgroup. For the African American subgroup, even though there was a decrease in likelihood of attaining a C or higher on Algebra 2 by Grade 11, the effect was negligible. Being an African American did not influence the attainment of C or higher on Algebra 2. However, for the African American subgroup, there was a decrease in the likelihood of attaining a 3 or higher on an AP exam or 4 or higher on an IB exam and the likelihood of attaining a 1650 on the SAT or 24 on the ACT.

Recommendations

1. Schools should identify students needing academic intervention prior to entering Grade 9 using existing tools such as the OSA prediction model that examines multiple academic and engagement factors in middle school to predict Grade 9 core course completion with 90% accuracy (Rethinam & Von Secker, 2011).

2. School staff should use the OSA prediction model to monitor progress toward closing achievement gaps and to identify individual students in need of targeted supports.

3. OSA should conduct a descriptive analysis of AP courses by race/ethnicity to inform discussions about which AP exams are taken by which subgroups of students and how that is related to college and career readiness.

4. Schools should have a multifaceted transition program in place to engage incoming Grade 9 students and parents and to communicate the importance of academic achievement in Grade 9.

5. The MCPS parent and community partnership should be engaged in the conversation of the importance of academic achievement of students in Grade 9.

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Grade 9 Indicators Influencing High School Graduation and College Readiness in Montgomery County Public High Schools

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Background

Importance of Graduating On Time and College Readiness

High schools are under tremendous pressure to increase graduation rates and lower dropout rates with federal legislation now requiring schools to report graduation rates (in Richmond, 2009). Nationally, nearly one third of students do not graduate from high school (Lloyd, 2007). However, according to *Education Week's* 2010 Diplomas Count, Montgomery County Public Schools (MCPS), Maryland topped the nation in its graduation rate of 83.1% for the Class of 2007, the most recent year for which data are available, well above the national average of 68.8% (Editorial Projects in Education Research Center, 2010).

Even though MCPS leads the nation in its graduation rate, concerns remain about students earning a high school diploma and not having the knowledge and skills necessary to succeed in postsecondary college and work training programs (ACT 2008; Boser & Burd, 2009, National Center for Public Policy and Higher Education, 2008; Strong American Schools, 2008). Also, students who drop out of school are more likely to have lower lifetime incomes and experience higher unemployment and higher incarceration rates (Sum, Khatiwada, Mclaughlin, & Palma, 2009).

To earn a living wage and advance one's career, even those not pursuing a college education will need to graduate from high school with equivalent knowledge and skills. To achieve this, the academic gap between high school graduation and college and workplace readiness must be bridged. A national movement is underway to ensure rigorous high school graduation standards, curriculum, and assessments aligned with college and career readiness (Conger & Tell, 2007).

MCPS monitors progress toward college readiness with the *Seven Keys to College Readiness* (Seven Keys), a K–12 trajectory that includes seven data points aligned with college readiness outcomes (Von Secker, 2009). The final three keys along this trajectory occur at the high school level, as delineated below:

- Key 5—Attainment of a C or higher in Algebra 2 by Grade 11
- Key 6—Attainment of an Advanced Placement (AP) exam score of 3 or higher or an International Baccalaureate (IB) exam score of 4 or higher
- Key 7—Attainment of an SAT combined mean score of 1650 or higher or an ACT score of 24 or higher

Why is Ninth Grade Important?

Researchers have identified ninth grade as the make or break year for completing high school (McCallumore & Sparapani, 2010; Fulk, 2003). This is because, nationally, more than one third of the students lost from the high school pipeline do not make the transition from ninth to tenth grade (Lloyd, 2007). Forty percent of students generally suffer serious problems after transitioning to high school (Akos & Galassi, 2004). Moreover, it is during the ninth grade year that many students first have to earn credits in core courses often required for high school graduation (Fulk, 2003). Research studies have indicated that ninth graders have the lowest grade point average, the most missed classes, the majority of failing grades, and more misbehavior referrals than any other high school grade level (Allensworth & Easton, 2005, 2007; Fritzer & Herbst, 1996). Therefore, to increase high school graduation rates and to prepare these students to be college and career ready early on, it is necessary to identify students experiencing difficulty in Grade 9, the reasons for their difficulty, and to examine how schools can help these students stay on the pathway to graduation and college and career readiness.

The Office of Shared Accountability (OSA) developed and previously published a prediction model that examined first semester Grade 8 factors that influenced the number of core credits students are likely to earn by end of Grade 9 (Rethinam & Von Secker, 2011). This prediction model is intended to help schools identify students at risk of not earning credits in one or more core courses. While this tool is used for decisions regarding incoming Grade 9 students, it does not include factors that occur during the Grade 9 year. For this reason, OSA is now researching Grade 9 factors that influence high school outcomes and expanding the existing prediction model to include these factors.

Literature Review

Academic Variables

High school is the first time that students earn credit for graduation over the course of four years (Fulk, 2003). Research by Allensworth & Easton (2005) on Chicago Public Schools (CPS) indicated that students who were on track at the end of Grade 9 were nearly four times more likely to graduate from high school than their peers who were not on track. The on-track indicator is measured in CPS in terms of students earning at least 10 semester credits (5 full-year course credits) and no more than one semester failure in a core course by the end of Grade 9 to be promoted to Grade 10. However, promotion requirements vary from one school district to another. The definition of on track for this study is aligned with the MCPS policy for promoting students from Grade 9 to Grade 10, which requires a minimum of five full credits including one for a required English course and one for a required mathematics course.

Even though the on-track indicator is highly predictive of graduation, the data for this indicator are not available until the end of Grade 9. Several other measures are readily available during Grade 9 and are highly predictive of graduation, including Grade Point Average (GPA), number of semester course failures, and days absent during Grade 9 (Allensworth & Easton, 2007). These variables can be monitored during the course of a student's Grade 9 school year.

GPA not only predicts future academic performance but also can be used to identify students who are at high risk of experiencing academic difficulty (ACT, 2008). Kurlaender, Reardon, & Jackson's (2008) study showed that seventh grade GPA was a consistently significant predicator of high school completion, controlling for other characteristics. Students with a higher GPA were more likely to graduate, on average, relative to their lower achieving counterparts, controlling for a variety of background characteristics.

Course failure has been consistently reported as having an influence on graduating from high school on time. One of the three most common reasons that students give for dropping out is failing courses (Catterall, 1998). Students who fail their classes are likely to begin questioning their ability to meet graduation requirements, lose interest or disengage in school, and eventually drop out of high school (Wagner, 1989).

Another aspect of school engagement is participation and involvement in extracurricular activities. In order for a student to pursue extracurricular opportunities, MCPS requires that students maintain a marking period average of 2.0 or better and fail no more than one course per marking period. Students who do not meet these academic standards are ineligible to participate in most extracurricular activities during the subsequent marking period. Academic eligibility for extracurricular activities is a reflection of student engagement with curriculum and instruction in their classes. Students who are chronically academically ineligible (ineligible three or four marking periods) also are likely to be disengaged from the instructional programs that prepare them for college and the workplace (Rethinam and Von Secker, 2008).

Student Behavioral Variables

Several researchers have found that high absence rates are strong predictors of dropping out (Neild & Balfanz, 2006; Alexander, Entwisle, & Horsey, 1997). The attendance rate during Grade 8 was found to have a strong predictive power for high school completion (Neild & Balfanz, 2006). Allensworth & Easton (2007) indicated that Grade 9 course attendance was eight times more predictive of course failures in freshman year than Grade 8 test scores.

School mobility was another factor that influenced graduation rate. Research studies show that there is a relationship between changing schools in middle grades and graduation rate. Students who changed schools between grades during middle school had considerably lower graduation rates from high school compared to their peers who did not change middle schools (Silver, Saunders, & Zarate, 2008).

Disciplinary problems have been consistently reported as one of the common characteristics of dropouts (Stroup & Robins, 1972). Researchers using longitudinal studies have identified the importance of behaviors as early as first grade in predicting high school dropout risk (Alexander, Entwisle, & Horsey, 1997; Ensminger & Slusarcick, 1992). In the MCPS study, student suspension status in Grade 9 was used as one of the behavioral variables.

Student Background Variables

Researchers have indicated that students' background factors—race/ethnicity, gender, and socio-economic status—are related to graduation (Rumberger, 2004; Alexander, Entwisle, & Kabbani, 2001). However, when researchers included other alterable variables (e.g., GPA and number of course failures) the variance in the graduation rate explained by the demographic factors became negligible. For example, Allensworth & Easton (2007) indicated that student background variables together explained about 12% of the variation in graduation rates in the cohort of students entering CPS high school; however, when students' Grade 9 GPA and number of courses failed in Grade 9 were included, an additional 39% of the variation in graduation rates was explained by the two variables.

In another study, Alexander, et al. (2001) reported that ninth grade performance (GPA, grade retention), behaviors (student behaviors), and attitudes (parent and pupil attitudes) together explained 44.1% of the variation in dropout rates; when background factors were added the variance explained increased by just under 6%. Once students' performance in Grade 9 is known, additional information about their background does little to improve the prediction of whether they will graduate or drop out.

Academic Achievement Prior to Grade 9

Performance on middle school tests is positively associated with high school completion (Silver, Saunders, & Zarate, 2008). Studies also have shown associations between Grade 8 achievement and college readiness (e.g., ACT, 2008). ACT identified factors at Grade 8 that are the most effective predictors of college and career readiness. Taking advanced/Honors courses in relevant subject areas, standard coursework (highest level of non-advanced, non-Honors courses taken in relevant subject area), and Grade 8 achievement were some of the Grade 8 factors that predicted college and career readiness (ACT, 2008).

Other studies have shown Algebra 1 completion as having an indirect association with graduation and college readiness. Students who took Algebra 1 by Grade 8 were far more likely to take calculus in high school and pursue higher education than those who did not (Riley, 1997; Cooney & Bottoms, 2002). One of MCPS' Seven Keys is successful completion of Algebra 1 with a C or higher by end of Grade 8 (Von Secker, 2009; Von Secker & Rethinam, 2010). Therefore, the MCPS study will use Grade 8 Algebra 1 completion with a C or higher as an indicator for prior achievement.

The purpose of this study is to examine: 1) Grade 9 factors that are related to graduating from high school in four years; and 2) the relationship between Grade 9 factors and three of the Seven Keys among MCPS students.

Methodology

Research Questions

1. What are the on-time graduation rates for students with different behavioral (attendance, mobility, and suspension) and academic (on track, GPA, ineligibility, number of semester course failure, and pass Algebra 1 with a C or higher by Grade 8) characteristics?
2. What are the college and career readiness rates on MCPS' three high school level keys to college readiness for students with different behavioral and academic characteristics?
3. Which of the factors are significantly related to graduating from high school four years later after taking into account the demographic and prior achievement variables?
4. Which of the factors are significantly related to college readiness keys after taking into account the demographic and prior achievement variables?

Study Population

The participants for this study included first-time Grade 9 students from all 25 high schools in MCPS. There were 10,147 first-time ninth graders at the end of the 2004–2005 school year. First-time Grade 9 students were included if they enrolled in June 2004 (Class of 2008) and had complete official transcript file information. Students who left the system or dropped out or transferred in during Grade 9 were excluded from this study. The final record for the MCPS study consisted of 9,162 students. Students' gender, race/ethnicity, participation in Free and Reduced-price Meals System (FARMS), special education, and English for Speakers of Other Languages (ESOL) services were based on the school district's records as reported at the end of the 2004–2005 school year.

Measures

The variables used for this study are selected based on research literature and are listed in Table A1 (see Appendix A). Detailed descriptions of some of the measures are presented below.

Outcome Measure

Graduation Status. On-time graduation is based on first-time Grade 9 students who graduated from high school in four years. Students who did not graduate in four years include certificate holders, dropouts, and those still in MCPS.

Algebra 2 with a C or Higher. MCPS has identified completion of Algebra 2 with a C or higher by the end of Grade 11 as one of the Seven Keys. It is calculated based on students receiving a C or higher in semester 1 and a C or higher in semester 2. (Von Secker, 2009 and 2010). Literature on the relationship between Algebra 2 completion in high school and college remediation has indicated that high school students who successfully complete Algebra 2 are less likely to need remediation upon entry to college and are more likely to enroll in college, remain in college, and earn a bachelors degree (Fong, Huang, & Goel, 2008; Horowitz, 2005; Von Secker, 2010).

AP 3 or higher or IB 4 or Higher. AP and IB examinations are criterion-referenced assessments that measure student performance in college-level courses. MCPS encourages students to take at least one AP exam by the end of Grade 12. AP and IB exam scores are reported in increments of 1 on scales that range from 1 to 5, and 1 to 7, respectively (Von Secker, 2009). Students who earn AP exam scores of 3 or higher or IB exam scores of 4 or higher may be awarded course credit upon entry to college (Di Yanni, 2008). Graduates who earn credits for AP courses and exams not only perform as well or better than non-AP graduates upon entry to college but also are more likely to complete a bachelor's degree (Hargrove, Godin, & Dodd, 2008; Morgan & Klaric, 2007; Scammacca & Dodd, 2005; Von Secker & Liu, 2010).

SAT 1650 or Higher or ACT 24 or Higher. The SAT and ACT are norm-referenced college entrance examinations that are used by colleges and universities to assess the relative college readiness of their applicants compared with test takers nationwide. SAT scores are reported in increments of 10 on a scale of 200 to 800 for each of the critical reading, math, and writing subtests. ACT composite scores are reported in increments of 1 on a scale of 1 to 36 (Von Secker, 2009). SAT and ACT scores are not statistically equivalent. However, an SAT combined score of 1650 (an average of 550 on each of the three subtests) corresponds to an ACT composite score of 24 (College Board, 2009). Students who attain these scores are unlikely to be required to take remedial coursework upon entry to college (Von Secker, 2009).

Grade Point Average. In MCPS, grade points are the numeric equivalent of a student's grade in a credit-bearing course, and the values are 4 points for an A, 3 for a B, 2 for a C, 1 for a D, and 0 for an E. The GPA is the average number of grade points earned per course in Grades 9 through 12, including grade points earned for successful completion of certain high school level courses taken while in middle school. The GPA is computed by dividing the total number of grade points earned by the total number of course credits included in the computation. Students receive a weighted GPA on their report card, which gives extra points to grades received in Honors, AP, or IB courses; however, for this study unweighted GPA was used for analyses.

Statistical Procedures

First, a set of two-way contingency table analyses using crosstabs were conducted to display the relationship between outcome variables and Grade 9 characteristics. Second, a set of logistic regression models were run for each of the outcomes of interest. Logistic regression is a useful way of describing the relationship between one or more independent variables with a binary dependent variable such as "graduated" or "did not graduate" in four years. Logistic regression illustrates the independent and combined effects of various factors related to high school graduation or other outcomes. These regression analyses determine relationship between groups of students while holding constant other predictors and controls.

The results of the logistic regression analyses are reported in odds ratio (OR), percent change in odds relative to comparison group, and effect size. The odds ratio was converted into percentages for easy interpretation (Chan, 2004). Effect size provides the magnitude of the relationship between predictor variables and outcome when all other variables are included in the model. Effect sizes (ES) are interpreted based on Cohen's d (Cohen, 1988): small (d = 0.2), modest (d = 0.5), and large (d = 0.8). A predictor has a positive effect if it increases the odds of the

outcome (e.g., graduation) and a negative effect if it decreases the odds of the outcome. The Wald estimate shows the "importance" of the contribution of each variable in the model (Chan, 2004). The higher the value, the more "important" is the predictor (Chan, 2004). The factors listed in Table A1 (see Appendix A) were used in logistic regression analyses; however, the final model included only those factors that were significantly related to the outcome. The tables in the following section therefore show only the significant predictors.

Results and Discussion

In the following section, the findings are organized by research questions.

Research Question 1. What are the on-time graduation rates for students with different behavioral and academic characteristics?

On-track Indicator and Graduation Rate

In MCPS, 95% of students who were on track for Grade 10 promotion graduated high school in four years, whereas only 52% of the students who were off track graduated high school in four years (Figure 1).
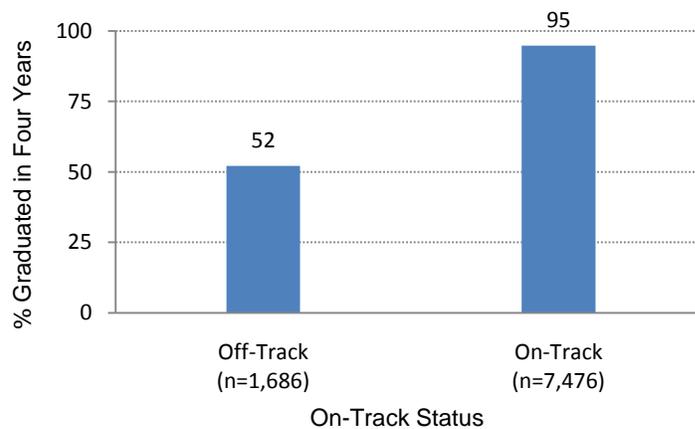
Figure 1. Grade 9 on-track status in 2004–2005.

Unweighted GPA and Graduation Rate

More than 97% of the students with a Grade 9 GPA of 2.5 or higher gradated high school in four years. Only 67% of students with a Grade 9 GPA less than 2.5 graduated in four years (Figure 2). While 67% of the students with a GPA less than 2.5 by the end of Grade 9 graduated four years later, it is a cause for concern because even though these students graduated high school in four years, they might not be college ready.
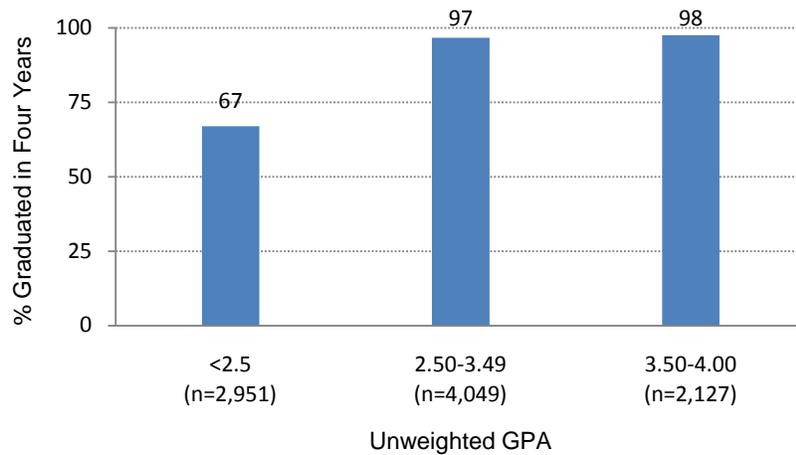
Figure 2. Grade 9 unweighted GPA in 2004–2005.

Number of Semester Course Failures and Graduation Rate

Ninety-six percent of students who had not failed any course at the end of Grade 9 graduated in four years. The percentage of students graduating decreased as the number of semester course failures increased. Eighty-one percent of students who failed one semester course in Grade 9 graduated four years later. However, only 45% of students who failed two or more semester courses (one or more full-year courses) during Grade 9 graduated in four years.
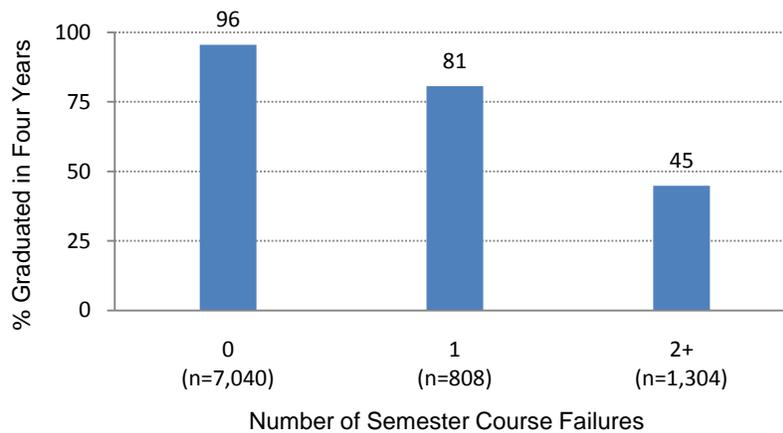
Figure 3. Grade 9 semester course failures in 2004–2005.

Number of Days Absent and Graduation Rate

Absences are reported by number of days absent and are not reported by course absences in the end-of-year student file. Ninety-three percent of the students who were absent anywhere between 0–8 days during Grade 9 graduated in four years. It is a concern if a student is absent for more than 8 days during Grade 9. Of students absent anywhere between 8.5–16.5 days, 78% graduated in four years. Of students absent for 17 days or more during Grade 9, only 48% graduated in four years (Figure 4).
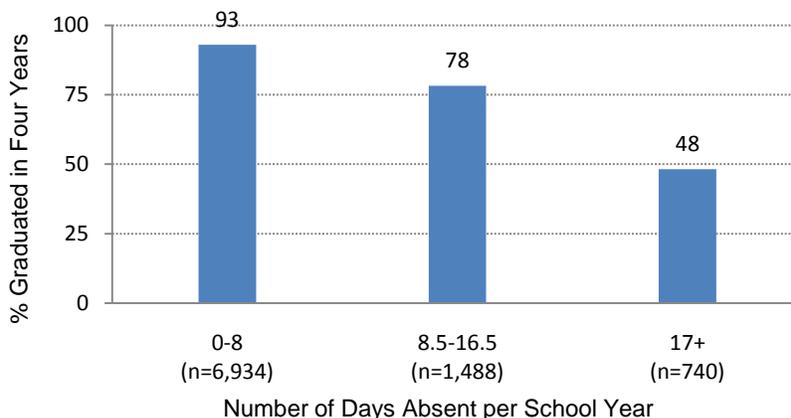
Figure 4. Number of days absent during Grade 9 in 2004–2005.

Ineligibility Status and Graduation Rate

Ineligibility status in MCPS is based on marking period averages and the number of course failures. Figure 5 indicates that 97% of the students who were never ineligible in Grade 9 graduated four years later. Seventy-six percent of students who were ineligible one or two marking periods during Grade 9 graduated in four years. Of the students who were ineligible three or four marking periods during Grade 9, only 43% graduated high school in four years.
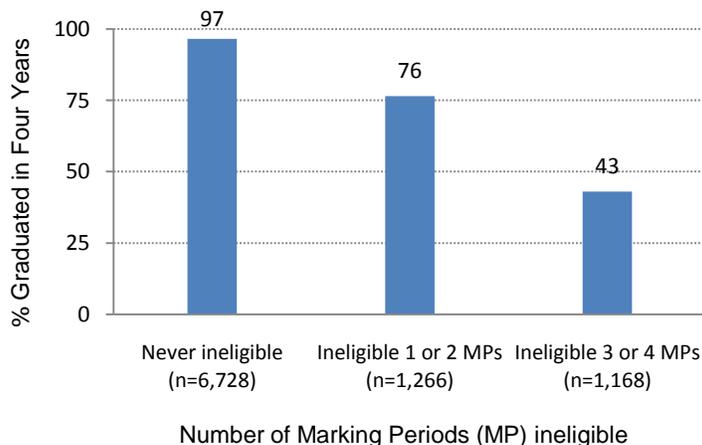
Figure 5. Grade 9 ineligibility status in 2004–2005.

Algebra 1 with a C or Higher By Grade 8 and Graduation Rate

Figure 6 indicates that 98% of the students who passed Algebra 1 with a C or higher by Grade 8 graduated four years later. More than half (77%) of students who did not pass Algebra 1 with a C or higher by Grade 8 graduated four years later.
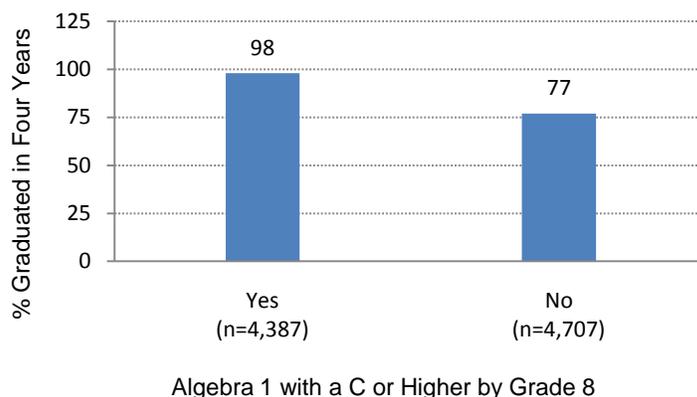
Figure 6. Algebra 1 with a C or higher by Grade 8 (prior to 2004–2005).

In summary, on-time graduation was higher for students who are on track for Grade 10 promotion, had a Grade 9 GPA of 2.5 or higher, failed one or fewer semester courses, were absent fewer than eight days, were never ineligible during Grade 9, and passed Algebra 1 with a C or higher by Grade 8.

Research Question 2. What are the college and career readiness rates on MCPS' three keys to college readiness for students with different behavioral and academic characteristics?

On-track Indicator and College-Readiness Rates

The Grade 9 on-track status also is related to the three high school keys to college readiness. More than one half of the students who were on track for Grade 10 promotion passed Algebra 2 with a C or higher by Grade 11 and had a score of 3 or higher on an AP exam or a 4 or higher on an IB exam. Forty-four percent of the on-track students scored 1650 or higher on the SAT or 24 or higher on the ACT during their high school years (Figure 7).

Even though 52% of students who were off track in Grade 9 graduated high school four years later (see Figure 1), less than 13% of these students passed Algebra 2 with a C or higher by Grade 11 and had a score of 3 or higher on an AP exam or a 4 or higher on an IB exam. Only 4% of the off-track students scored a 1650 or higher on the SAT or 24 or higher on the ACT (Figure 7).
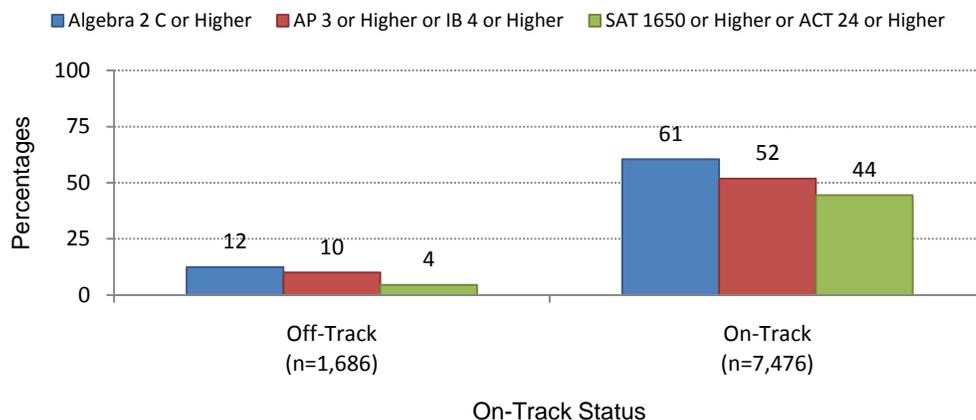
Figure 7. Grade 9 on-track status in 2004–2005 by outcomes.

Unweighted GPA and College-Readiness Rates

The majority (88%) of students with a freshman GPA between 3.5 and 4.0 scored a C or higher on Algebra 2 by Grade 11. Ninety percent had a score of 3 or higher on an AP exam or 4 or higher on an IB exam and 84% scored 1650 or higher on the SAT or 24 or higher on the ACT (Figure 8). The percentage of students meeting keys decreased as students' Grade 9 GPA dropped. Of students with a Grade 9 GPA between 2.5 and 3.49, 64% passed Algebra 2 with a C or higher, 48% attained a 3 or higher on an AP exam or 4 or higher on an IB exam, and 38% scored 1650 or higher on the SAT or 24 or higher on the ACT (Figure 8). Even though 97% of these students graduated high school in four years (see Figure 2), less than one half of these students met the criteria for college readiness on two of the three keys, and slightly more than one half met the criteria for Algebra 2 with a C or higher.

When a student's Grade 9 GPA is less than 2.5, the likelihood of that student attaining the three keys to college readiness is bleak. Only 10% of students with a GPA less than 2.5 in Grade 9 had a score of C or higher on Algebra 2 and a score of 3 or higher on an AP exam or 4 or higher on an IB exam. Only 3% of the students with a GPA less than 2.5 scored 1650 or higher on the SAT or 24 or higher on the ACT (Figure 8). This is a cause for concern as one third of the ninth graders in this study had a GPA of 2.5 or below.
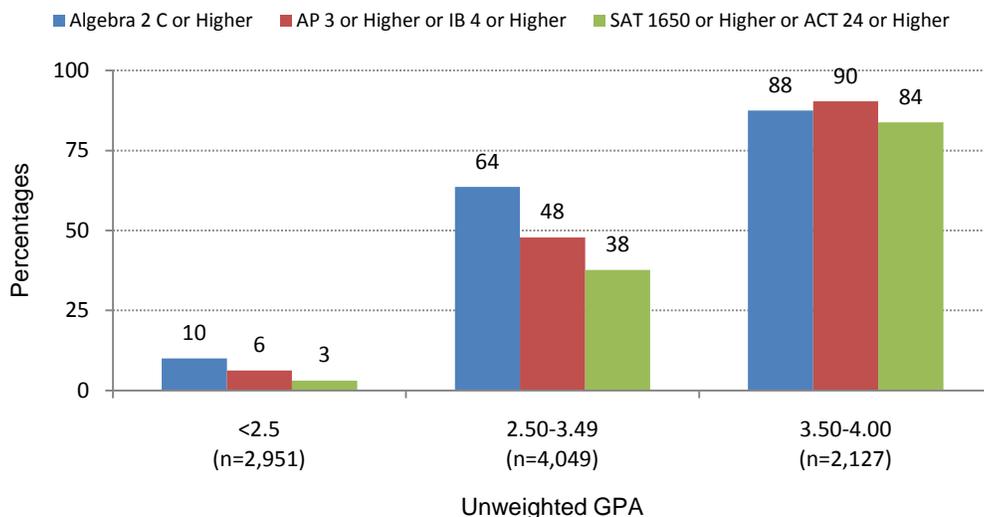
Figure 8. Grade 9 unweighted GPA in 2004–2005 by outcomes.

Number of Semester Course Failures and College-Readiness Rates

More than one half of students who did not fail any course during Grade 9 passed Algebra 2 with a C or higher by Grade 11 (65%) and had a score of 3 or higher on an AP exam or a 4 or higher on an IB exam (55%). Close to one half (47%) of the students scored 1650 or higher on the SAT or 24 or higher on the ACT (Figure 9).

Notably, while four fifths of students who failed one course during Grade 9 graduated on time, less than 20% of them attained the three keys or were college ready (see Figure 3). This might mean that even though these students graduated high school in four years, they may not have the knowledge and skills required for college and career readiness. Less than 5% of students who failed two or more semester courses (one or more full-year courses) in Grade 9 met any of the three keys (Figure 9).
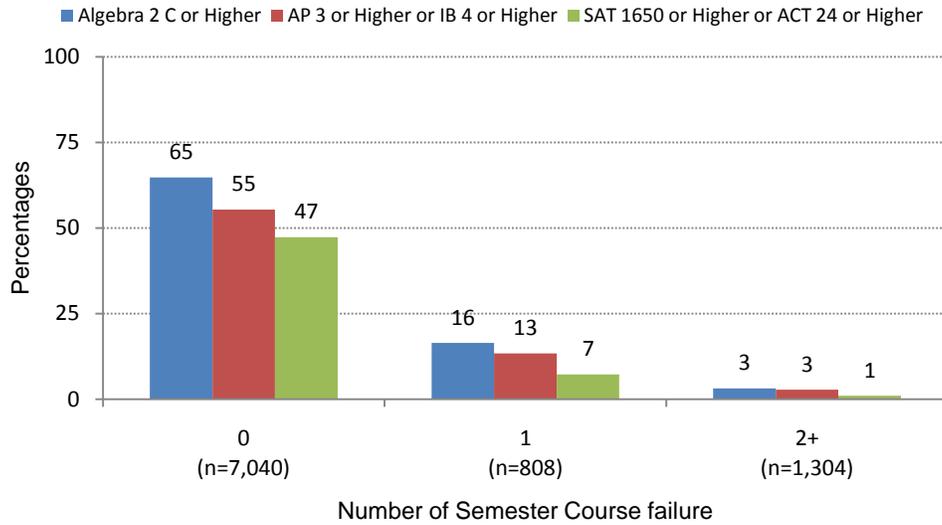
Figure 9. Grade 9 semester course failure in 2004–2005 by outcomes.

Number of Days Absent and College-Readiness Rates

Of students who were absent 0–8 days during Grade 9, 59% scored a C or higher in Algebra 2 by Grade 11, 51% scored a 3 or higher on an AP exam or 4 or higher on an IB exam, and 43% scored 1650 or higher on the SAT or 24 or higher on the ACT. As the number of days absent increased, the percentage of students meeting the three keys decreased (Figure 10).
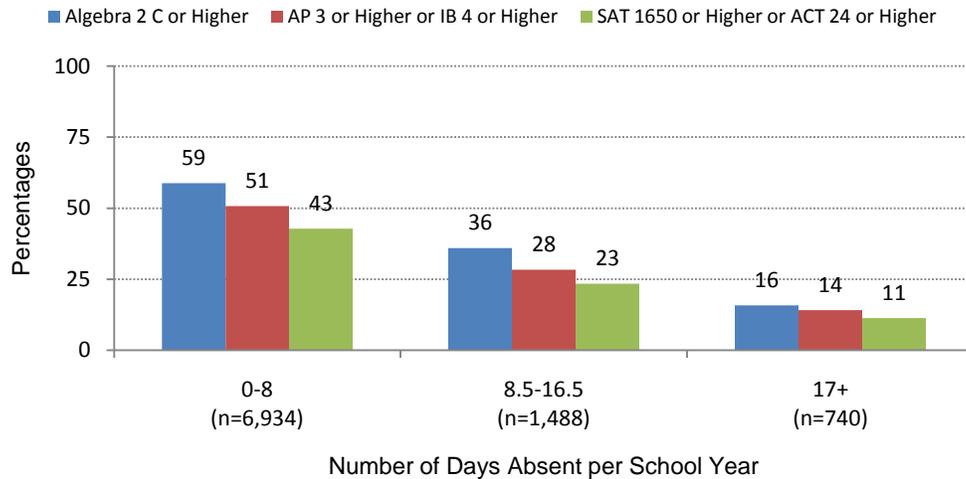
Figure 10. Number of days absent during Grade 9 in 2004–2005 by outcomes.

Ineligibility Status and College-Readiness Rates

Of students who were never ineligible during Grade 9, 67% scored a C or higher in Algebra 2 by Grade 11, 58% scored 3 or higher on an AP exam or 4 or higher on an IB exam, and 49% scored 1650 or higher on the SAT or 24 or higher on the ACT. The percentages of students attaining theses outcomes decreased as students were ineligible one or two marking periods during Grade 9. When students were ineligible three or four marking periods (chronically ineligible), less than 3% of these students met any of the three keys to college readiness (Figure 11).
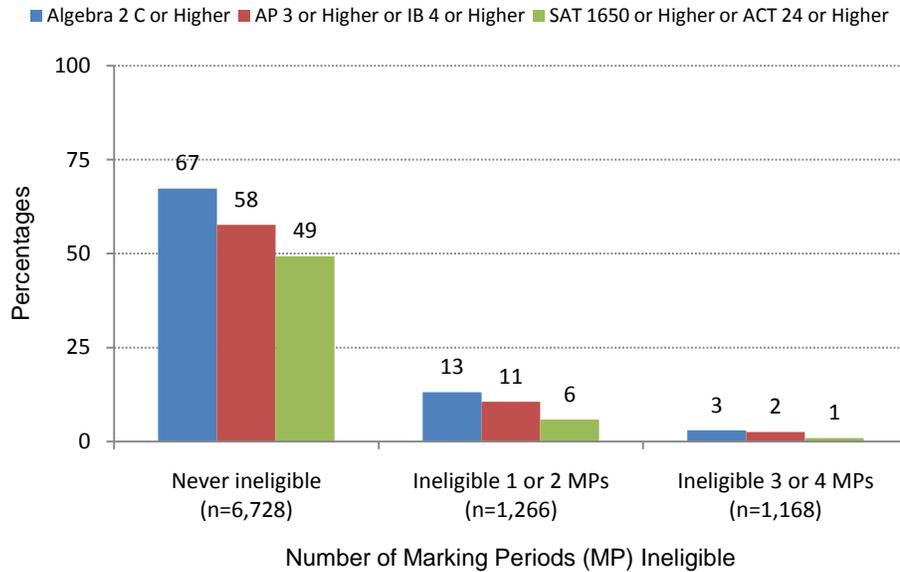
Figure 11. Grade 9 ineligibility status in 2004–2005 by outcomes.

Algebra 1 with a C or Higher By Grade 8 and College-Readiness Rates

Even though 77% of students who did not pass Algebra 1 with a C or higher graduated high school four years later (Figure 6), less than 27% scored a C or higher in Algebra 2 by Grade 11, 15% scored 3 or higher on an AP exam or 4 or higher on an IB exam, and 8% scored 1650 or higher on the SAT or 24 or higher on the ACT (Figure 12).

■ Algebra 2 C or Higher   ■ AP 3 or Higher or IB 4 or Higher   ■ SAT 1650 or Higher or ACT 24 or Higher
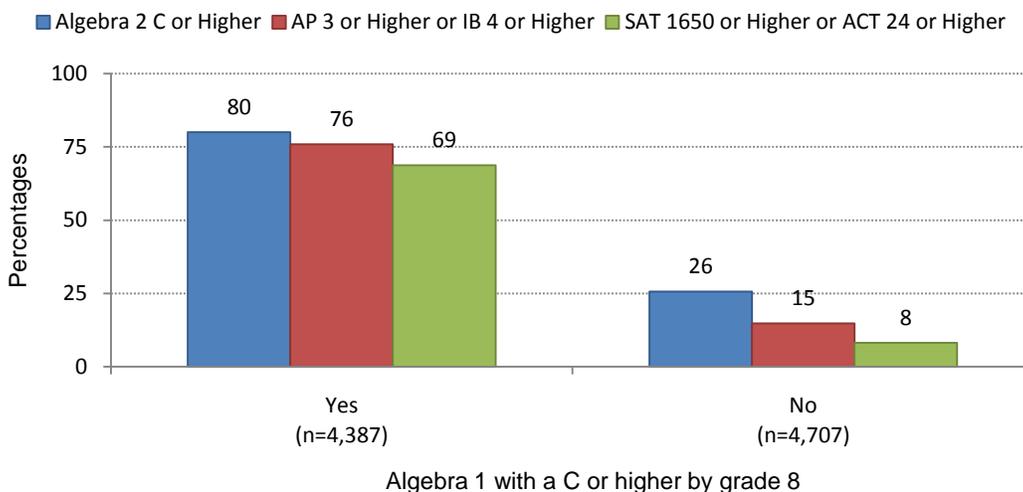
Figure 12. Algebra 1 with a C or higher by Grade 8 (prior to 2004–2005).

In summary, descriptive analysis revealed that college-readiness outcomes were higher for Grade 9 students who were on track for Grade 10 promotion, absent fewer than eight days, never ineligible during Grade 9, had a Grade 9 GPA of 3.5 or higher, had failed no semester courses, and passed Algebra 1 with a C or higher by Grade 8.

Cross-tabulations of the variables that are not shown as figures above but were included for analyses are reported in Table B1 (see Appendix B). The cross-tabulations provided in the preceding sections of the report demonstrate the relationship between outcomes (on-time graduation and meeting three keys to college readiness) and Grade 9 academic and behavioral variables. However, the above section does not shed light on how these factors together explain outcomes (graduation and meeting three keys).

The following sections provide results from logistic regression analyses conducted to test whether the associations discussed above were significant and/or meaningful. Several logistic regressions were used to examine the factors that influenced the outcomes. The model estimated the magnitude of the predictors and the significance level simultaneously. These statistical models do not determine whether there is a causal relationship between the predictor and the outcomes. These models help determine what variables are more important when other variables are included or controlled for in the model. The factors listed in Table A1 (see Appendix A) were used in logistic regression analyses; however, the final model included only those factors that were significantly related to the outcomes. The tables in the following section therefore show only the significant predictors.

Research Question 3. Which of the Grade 9 factors are significantly related to graduating from high school four years later after taking into account the demographic and prior achievement variables?

Of the variables that had a significant relationship to graduating on time, Grade 9 GPA, being on track, and passing Algebra 1 with a C or higher by Grade 8 increased the odds of graduating on time (Table 1). Conversely, FARMS and special education status, suspension, number of days absent during Grade 9, and school mobility significantly decreased the odds of graduating on time. The magnitude of effect (ES) was negligible for days absent during Grade 9 and Grade 9 suspension and was small for current FARMS status and school mobility.

Table 1. Predictors of High School Graduation

Grade 9 Variables	B	S.E.	Wald	sig	Odds Ratio (OR)	% change in Odds[a]	ES[b]
Current FARMS	-0.37	0.09	16.76	0.00	0.69	-30.87	0.20
Current special ed.	-0.71	0.09	61.08	0.00	0.49	-51.05	0.39
Algebra 1 C or higher by Grade 8	0.80	0.14	32.98	0.00	2.23	122.75	0.44
School mobility during middle school	-0.39	0.09	19.22	0.00	0.68	-32.37	0.22
Suspension during Grade 9	-0.34	0.12	7.56	0.01	0.71	-28.74	0.19
Grade 9 on-track status	1.12	0.09	146.48	0.00	3.07	206.99	0.62
Grade 9 GPA	1.15	0.07	275.04	0.00	3.16	216.14	0.64
Days absent during Grade 9	-0.04	0.00	92.20	0.00	0.96	-4.38	0.02
Constant	1.70	0.10	287.51	0.00	5.46		

[a] Percent change in odds = (OR -1) *100 (Chan, 2004).
[b] The formula below puts effect sizes, Cohen's *d*, and the odds ratio on a common metric (Kline, 2004).

$$\text{logit } d = \frac{\ln(\text{Exp(B)})}{pi/\sqrt{3}}$$

For every one point increase in GPA above 2.5, the odds of graduating high school on time increased by 3.2 times. Students with an Algebra 1 score of a C or higher are 2.2 times more likely than students with an Algebra 1 score below C or no algebra by Grade 8 to graduate on time. Students who are on track were 3.1 times more likely than off-track students to graduate on time. For students who were eligible for FARMS and special education services during Grade 9, the odds of graduating on time decreased by 31% and 51% respectively. For students who were suspended during Grade 9, the odds of graduating on time decreased by 29%.

In summary, the statistically significant and meaningful factors that influenced on-time graduation were: Grade 9 GPA, being on track, passing Algebra 1 with a C or higher, and being eligible for special education services. Other factors that were statistically significant but had a small or negligible effect were: FARMS status, suspension, number of days absent during Grade 9, and school mobility.

Research Question 4. Which of the Grade 9 factors are significantly related to college readiness keys after taking into account the demographic and prior achievement variables?

Three logistic regression models were conducted to examine the relationship between Grade 9 factors and outcomes (Tables 2, 3, and 4).

Factors Influencing Attainment of C or Higher on Algebra 2 by Grade 11

The variables that had a significant relationship to attainment of C or higher on Algebra 2 by Grade 11 (Table 2) were: Grade 9 GPA, Algebra 1 C or higher by Grade 8, academic eligibility

during Grade 9, eligibility for special education services, and the Hispanic subgroup. The effect sizes for association between Asian American and African American students and days absent during Grade 9 and attaining a C or higher on Algebra 2 by Grade 11 were small or negligible. This suggests that number of days absent during Grade 9 and belonging to an Asian American or African American subgroup does not affect the attainment of a C or higher in Algebra 2 by Grade 11 when other variables are considered in the model.

Table 2. Predictors of Attainment of C or Higher on Algebra 2 by Grade 11

Grade 9 Variables	B	S.E.	Wald	sig	Odds Ratio (OR)	% change in Odds[a]	ES[b]
Asian American	-0.23	0.09	6.87	0.01	0.80	-20.21	0.12
African American	-0.35	0.08	19.92	0.00	0.70	-29.74	0.20
Hispanic	-0.51	0.09	35.21	0.00	0.60	-39.77	0.28
Current special ed.	-0.48	0.08	36.95	0.00	0.62	-38.15	0.27
Algebra 1 C or higher by Grade 8	1.01	0.06	256.10	0.00	2.76	175.55	0.56
Ineligibility	-0.46	0.09	28.74	0.00	0.63	-36.83	0.25
Grade 9 GPA	1.70	0.07	565.55	0.00	5.46	445.89	0.94
Days absent during Grade 9	-0.02	0.01	13.43	0.00	0.98	-1.85	0.01
Constant	-1.07	0.08	163.89	0.00	0.34		

[a] OR in percentage = (OR -1) *100 (Chan, 2004).
[b] The formula below puts effect sizes, Cohen's d, and the odds ratio on a common metric (Kline, 2004).
logit $d = \dfrac{\ln(\text{Exp(B)})}{pi/\sqrt{3}}$

For every one point increase in GPA above 2.5, the odds of attaining a C or higher on Algebra 2 by Grade 11 increased by 5.5 times. Students with an Algebra 1 score of C or higher by Grade 8 were 2.8 times more likely to attain a C or higher in Algebra 2 by Grade 11 than students with an Algebra 1 score below C or with no algebra. Being in a Hispanic subgroup decreased the odds of attaining a C or higher in Algebra 2 by Grade 11 by 40%. Having an academic ineligibility during Grade 9 decreased the odds of attaining a C or higher in Algebra 2 by Grade 11 by 37%. Being eligible for special education services during Grade 9 decreased the odds of attaining a C or higher in Algebra 2 by Grade 11 by 38%.

Factors Influencing Attainment of a 3 or Higher on an AP Exam or 4 or Higher on an IB Exam

The variables that had a significant relationship to attainment of a 3 or higher on an AP exam or 4 or higher on an IB exam (Table 3) were: Grade 9 GPA, Algebra 1 with a C or higher by Grade 8, eligible for special education services, and the African American subgroup. The effect size was small or negligible for being in a Hispanic subgroup or being eligible for ESOL services.

Table 3. Predictors of Attainment of a 3 or Higher on an AP Exam or 4 or Higher on an IB Exam

Grade 9 Variables	B	S.E.	Wald	sig	Odds Ratio (OR)	% change in Odds[a]	ES[b]
African American	-0.62	0.09	48.55	0.00	0.54	-46.04	0.34
Hispanic	0.25	0.09	7.43	0.01	1.29	28.96	0.14
Current ESOL	-0.36	0.15	5.52	0.02	0.70	-30.30	0.20
Current special ed.	-0.84	0.09	82.45	0.00	0.43	-56.76	0.46
Algebra 1 C or higher by Grade 8	1.51	0.07	511.76	0.00	4.53	353.49	0.84
Grade 9 GPA	2.32	0.07	1182.62	0.00	10.13	912.97	1.28
Constant	-1.82	0.07	721.62	0.00	0.16		

[a] OR in percentage = (OR -1) *100 (Chan, 2004).
[b] The formula below puts effect sizes, Cohen's *d*, and the odds ratio on a common metric (Kline, 2004).

$$\text{logit } d = \frac{\ln(\text{Exp(B)})}{pi/\sqrt{3}}$$

For every one point increase in GPA above 2.5, the odds of attaining a 3 or higher on an AP exam or 4 or higher on an IB exam increased by 10 times. Students with an Algebra 1 score of C or higher were 4.5 times more likely than students with Algebra 1 score below C or no algebra by Grade 8 to attain a 3 or higher on an AP exam or 4 or higher on an IB exam. Being in an African American subgroup decreased the odds of attaining a 3 or higher on an AP exam or 4 or higher on an IB exam by 46%. Being eligible for special education services during Grade 9 decreased the odds of attaining a 3 or higher on an AP exam or 4 or higher on an IB exam by 57%.

Factors Influencing Attainment of 1650 or Higher on the SAT or 24 or Higher on the ACT

The variables that had a significant relationship to attaining a 1650 or higher on the SAT or 24 or higher on the ACT (Table 4) in the order of magnitude (ES) were: GPA in Grade 9, Algebra 1 C or Higher by Grade 8, FARMS status in Grade 9, and being a Hispanic or African American student.

Table 4. Predictors of Attainment of 1650 or Higher on the SAT or 24 or Higher on the ACT

Grade 9 Variables	B	S.E.	Wald	sig	Odds Ratio (OR)	% change in Odds[a]	ES[b]
African American	-0.81	0.10	62.61	0.00	0.44	-55.57	-0.45
Hispanic	-0.98	0.12	71.62	0.00	0.37	-62.63	-0.54
Current FARMS	-1.26	0.13	95.97	0.00	0.28	-71.75	-0.70
Algebra 1 C or higher by Grade 8	1.86	0.07	654.02	0.00	6.43	542.96	1.03
Grade 9 GPA	2.31	0.07	987.97	0.00	10.11	911.10	1.28
Constant	-2.49	0.08	1067.48	0.00	0.08		

[a] OR in percentage = (OR -1) *100 (Chan, 2004).
[b] The formula below puts effect sizes, Cohen's *d*, and the odds ratio on a common metric (Kline, 2004).

$$\text{logit } d = \frac{\ln(\text{Exp(B)})}{pi/\sqrt{3}}$$

For every one point increase in GPA above 2.5, the odds of attaining a 1650 on the SAT or 24 on the ACT increased by 10 times. Students with an Algebra 1 score of C or higher were 6.4 times more likely than students with Algebra 1 score below C or no algebra by Grade 8 to attain a 1650 on the SAT or 24 on the ACT. Being eligible for FARMS services during Grade 9 decreased the

odds of attaining a 1650 on the SAT or 24 on the ACT by 72%. Being in an African American or Hispanic subgroup decreased the odds of attaining a 1650 on the SAT or 24 on the ACT by 56% and 63%, respectively (Table 4).

In summary, the most important factors that influenced the three keys (attaining a C or higher in Algebra 2 by Grade 11, attaining a 3 or higher on an AP exam or 4 or higher on an IB exam, and attaining a 1650 on the SAT or 24 on the ACT) were: Grade 9 GPA and passing Algebra 1 with a C or higher by Grade 8. Ineligibility or being eligible for special education services were significantly related to attaining a C or higher in Algebra 2 by Grade 11. Even though the effect size was negligible, being a Hispanic student was a significant positive predictor of attaining a 3 or higher on an AP exam or 4 or higher on an IB exam. This could be because a significant number of Hispanic students may have taken AP Spanish exams and as such may have contributed to the significant positive relationship between being Hispanic and attaining 3 or higher on an AP exam or 4 or higher on an IB exam.

There were demographic disproportionalities in the attainment of the three keys. Being in the Hispanic subgroup decreased the odds of attaining a C or higher on Algebra 2 by Grade 11 and the odds of attaining a 1650 on the SAT or 24 on the ACT by 40% and 63%, respectively. Even though there was a significant negative relationship to being in the African American subgroup and attainment of a C or higher on Algebra 2 by Grade 11, the effect was negligible. However, being in an African American subgroup decreased the odds of attaining a 3 or higher on an AP exam or 4 or higher on an IB exam and the odds of attaining a 1650 on the SAT or 24 on the ACT by 46% and 56%, respectively. The above findings about MCPS students are not surprising given the racial/ethnic disproportionalities in college and career readiness observed nationally (Maryland Higher Education Commission, 2008; National Center for Public Policy and Higher Education, 2008) even though MCPS is striving to reduce the racial/ethnic gap.

Conclusions

The on-time graduation rate was higher for students who had a GPA of 2.5 or higher, failed one or fewer semester courses, were absent fewer than eight days, and were never ineligible in any marking period during Grade 9. The findings are consistent with studies reported in the literature (Allensworth & Easton, 2005/2007; ACT, 2008; Catterall, 1998; Kurlaender, et al., 2008). Once these academic and behavioral variables were included in the model, students' race/ethnicity and ESOL status became non-significant in predicting graduation (Allensworth & Easton, 2007; Alexander, et al., 2001; Rumberger, 2004). Even though the graduation rate was higher for students with a certain Grade 9 profile, the college-readiness rates were lower for students with the same Grade 9 profile. This means that students might graduate in higher numbers but they might not be college ready.

The findings from this study indicate that college-readiness rates were lower for students who were off track, had a GPA between 2.5 and 3.49, failed one or more semester courses, were absent more than eight days, and were ineligible one or more marking periods during Grade 9. In a qualitative study, Zsiray (1996) reported that some ninth graders do not realize the importance of the ninth grade year. When asked, students who failed one or more classes during ninth grade

stated that they wished they better understood the importance of the freshman year on graduation. If this had been the case they claimed that they would have worked harder to achieve higher grades.

The findings from the logistic regression analyses showed two variables that were significantly positively related to all four outcomes (graduating on time, attaining a C or higher in Algebra 2 by Grade 11, attaining a 3 or higher on an AP exam or 4 or higher on an IB exam, and attaining a 1650 on the SAT or 24 on the ACT). The two variables were passing Algebra 1 with a C or higher and attaining a Grade 9 GPA of 2.5 or higher. Being on track for Grade 10 promotion was significantly positively related to graduation but did not have a significant relationship to the three keys. This might be because the on-track status as defined by MCPS might not be rigorous enough to be an indicator for a students' college readiness. There are other factors a student experiences during the course of high school that also might influence a student's college readiness.

This study finding indicated that being in a certain racial/ethnic group had a significant negative relationship with one or more of the three keys to college readiness. Schools cannot alter students' demographic characteristics; however they can alter students' academic and behavioral variables. By identifying the alterable variables, schools can design interventions that may address those characteristics. School staff can examine whether a student is on track by determining if that student has attained Key 4 (Algebra 1 by Grade 8) prior to entering Grade 9.

Schools also can monitor students' ineligibility status during Grade 9. Ineligibility is based on marking period average and course failure in each quarter; therefore, unlike on-track status and GPA, ineligibility and number of course failures can be monitored by schools during the school year. School staff does not have to wait until the end of the year to get the data and can take necessary action to help struggling students early on.

Recommendations

1. Schools should identify students needing academic intervention prior to entering Grade 9 using existing tools such as the OSA prediction model that examines multiple academic and engagement factors in middle school to predict Grade 9 core course completion with 90% accuracy (Rethinam & Von Secker, 2011).

2. School staff should use the OSA prediction model to monitor progress toward closing achievement gaps and to identify individual students in need of targeted supports.

3. OSA should conduct a descriptive analysis of AP courses by race/ethnicity to inform discussions about which AP exams are taken by which subgroups of students and how that is related to college and career readiness.

4. Schools should have a multifaceted transition program in place to engage incoming Grade 9 students and parents and to communicate the importance of academic achievement in Grade 9.

5. The MCPS parent and community partnership should be engaged in the conversation of the importance of academic achievement of students in Grade 9.

Limitations

This study is based on a single cohort of students and cannot be generalized beyond MCPS first-time Grade 9 students. The results from the logistic models with three keys to college readiness outcomes should be interpreted with caution. Because the *Seven Keys to College Readiness* initiative of MCPS was implemented in the 2009 school year and the cohort for this study is the Class of 2009, most of these students graduated before the keys were implemented.

Acknowledgements

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Appendix A

Table A1. Variables and Descriptions

Variables	Variable Description
Dependent Variables	
On-time graduation	A binary variable produced by the school district. 1 = graduated in four years (2007–2008); 0 = student did not graduate from the district by 2007–2008.
Algebra 2 by Grade 11 with a C or higher	A binary variable created using the course history of the student. 1 = students passed Algebra 2 with a C or higher in 2006–2007, or 11th grade for on-time students; 0 = did not pass Algebra 2 with a C or higher in 2006–2007.
AP/IB Score	A binary variable obtained from the AP/IB score data. 1 = scored 3 or higher on AP or 4 or higher on IB; 0 = student did not score 3 or higher on AP or 4 or higher on IB.
SAT/ACT Score	A binary variable obtained from the SAT/ACT score data. 1 = scored 1650 or higher on SAT or 24 or higher on ACT; 0 = student did not score 1650 or higher on SAT or 24 or higher on ACT.
Independent Variables	
Asian American	A binary variable indicating whether a student is an Asian American. 1 = Asian American; 0 = not Asian American (White is the reference group).
African American	A binary variable indicating whether a student is an African American. 1 = African American; 0 = not African American (White is the reference group).
Hispanic	A binary variable indicating whether a student is a Hispanic. 1 = Hispanic; 0 = not Hispanic (White is the reference group).
FARMS	A binary variable indicating whether a student was designated as FARMS in 2004–2005. 1 = classified as current FARMS; 0 = classified as never FARMS or prior FARMS.
ESOL	A binary variable indicating whether a student was designated as ESOL in 2004–2005. 1 = classified as current ESOL; 0 = classified as never ESOL or prior ESOL.
Special education (SPED)	A binary variable indicating whether a student was designated as SPED in 2004–2005. 1 = classified as current SPED; 0 = classified as never SPED or prior SPED.
Algebra 1 C or Higher by Grade 8	A binary variable created using the course history of the student. 1 = students passed Algebra 1 with a C or higher prior to 2004–2005, or prior to Grade 9 for on-time students; 0 = did not pass Algebra 1 with a C or higher prior to 2004–2005.
School mobility in middle school	Number of times students moved between schools during their middle school years. Mobility is based on end of the school year and not within school year. A binary variable was created. 1 = changed schools more than one time during middle school; 0 = did not change schools during middle school.
Suspension	A binary variable indicting whether a student was suspended in 2004-2005. 1 = classified as suspended in 2004–2005; 0 = classified as never suspended or was suspended prior to 2004–2005.
Academic eligibility	Coded as -1 = never ineligible (always eligible), 0 = 1 or 2 MPs ineligible; 1 = 3or 4 MPs ineligible.
On-track status	A binary variable indicating whether students had a minimum of five full credits including one for a required English course and one for a required mathematics course in 2004–2005 to be promoted to Grade 10. 1 = students were on-track; 0 = students were not on-track.
GPA	Continuous variable ranging between 1 and 4 and is centered at 2.5.
Fail one semester course	A binary variable where 1 = failed one semester course by end of 2004–2005; 0 = other; -1 = did not fail any semester courses (Reference group).
Fail two or more semester courses	A binary variable where 1 = failed two or more semester courses by end of 2004–2005; 0 = other; -1 = did not fail any semester courses (Reference group).
Days absent	Continuous variable centered at 7.

Note. FARMS = Free and Reduced-price Meals System; ESOL = English for Speakers of Other Languages.

Appendix B

Table B1. Cross-tabulations Between Grade 9 Factors and Outcomes

	Variables	N Students	In percentages			
			Graduated in four years	Algebra 2 with a C or higher by Grade 11	AP 3 or higher or IB 4 or higher	SAT 1650 or higher or ACT 24 or higher
Race/Ethnicity	Asian American	1325	95.0	69.1	62.5	54.3
	African American	1935	77.9	29.1	17.2	11.0
	White	4281	93.3	65.7	57.5	53.8
	Hispanic	1594	74.2	27.0	25.8	10.0
ESOL	Never or prior ESOL	8737	87.6	52.7	45.0	38.5
	Current ESOL	425	72.7	30.6	25.6	7.8
FARMS	Never or prior FARMS	7584	90.2	56.8	49.4	43.4
	Current FARMS	1578	71.4	26.9	18.6	7.1
Special education	Never or prior SPED	7514	90.1	56.5	49.6	41.4
	Current SPED	1648	72.6	29.7	19.2	17.5
Suspension	Never or prior suspension	8616	89.3	54.2	46.4	39.2
	Current suspension	546	49.6	11.9	7.9	4.9
Middle school mobility	Never moved between schools	7187	89.6	55.2	47.3	40.9
	Moved one or more times between schools	1975	77.4	38.7	32.6	23.4

Note. FARMS = Free and Reduced-price Meals System; ESOL = English for Speakers of Other Languages; SPED = Special Education.