MHEC
MARYLAND HIGHER EDUCATION COMMISSION

Report on Unmet Need and Student Success at Maryland Public Four-Year Institutions

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Executive Summary

This report builds on the 2013 and 2014 Reports on Unmet Need and Student Success at Maryland Public Four-Year Institutions by providing data on six-year graduation rates for the students in the original 2008 entering cohort.

For this report, both descriptive analysis and logistic regression were used to understand the relationship between students' unmet need and their graduation outcomes and to examine the impact of net cost of attendance on five- and six-year degree completion. Net cost of attendance (NCOA) is defined as the student's cost of attendance (including tuition and fees, room and board, books and supplies, and transportation), minus all financial aid (including grants, scholarships, loans, and other forms of aid) received from all sources (federal, state, institutional, and private). Need is calculated by subtracting the student's expected family contribution from the NCOA. Students were considered to have unmet need when their need was greater than zero.

The primary findings of the research suggest that five- and six-year graduation rates are affected by students' unmet need and family income; those from the lowest income families and with the greatest unmet need are the least likely to graduate. Regression findings reveal that increases in NCOA can have a significant negative effect on five- and six-year graduation rates of students from the lowest income families (those with family incomes between $0 and $65,513). Nevertheless, students in the lowest income brackets are the most likely to see graduation rates improve when they receive sufficient financial aid to meet their need. Among students from higher-income families (those with family incomes of $100,742 or more), students with unmet need have similar graduation rates to those without unmet need.

A secondary finding is that the grade point average (GPA) that a student earns in the first year in college is a stronger predictor of graduation than NCOA or family income. It seems logical that first-year GPA would be a strong predictor of graduation, as grades measure factors such as motivation, work habits, and subject mastery, which are considered necessary for degree completion. Yet, as the descriptive findings show, these positive effects on graduation provide a disproportionate benefit for those students who have no unmet need, for their graduation rates are consistently higher than those with unmet need.

These findings corroborate the earlier unmet need reports showing that an effective and efficient way to use financial aid to improve graduation rates is to meet or overmeet the financial need of low-income students. It also suggests that graduation rates would be improved by sustained efforts to improve college readiness at the high school level and college performance at the college level, especially for low-income students.

Introduction

In 2013 and 2014, the Joint Chairmen's Report charged the Maryland Higher Education Commission (MHEC) to examine the impact of financial need on college student retention and graduation. The charge in the 2013 Joint Chairmen's Report stated:

> …the State is to work toward breaking down financial barriers for higher education. To determine the State's progress on this goal, the Maryland Higher Education Commission (MHEC) has begun an analysis of student financial need and financial aid using the Financial Aid Information System data for the fiscal 2011 cohort. The committees request that MHEC enhance this report and analyze progression, retention, and graduation data from public four-year institutions and compare levels of financial need met and the amount of unmet need remaining, both before and after loans are included.

MHEC has prepared the current report to provide a more complete analysis of the data. This report builds on the two earlier reports by providing data on six-year graduation rates for the students in the original entering cohort, and provides further support for the conclusions in those reports that students from the lowest-income families are the most likely to benefit from increases in financial aid, and that meeting the full financial need of students from low-income families appears to be the most effective strategy for using financial aid to increase graduation rates.

Background

In 2013, in response to the Joint Chairmen's Report request, MHEC prepared a study regarding the impact of net cost of attendance (NCOA) on student persistence and completion when students' family income was considered. NCOA is defined as the student's cost of attendance (including tuition and fees, room and board, books and supplies, and transportation), minus all financial aid (including grants, scholarships, loans, and other forms of aid) received from all sources (federal, state, institutional, and private). The study then calculated "need" by subtracting the student's expected family contribution (EFC), which is determined according to a standard federal formula, from the NCOA. Students were considered to have unmet need when their need was greater than zero. Students with a negative NCOA received more aid than their cost of attendance and were considered to have "overmet need." A smaller number of students had no unmet need (their NCOA was zero) and were included in the analysis with those with overmet need.

For the purposes of this report, those students who are referenced as having "no unmet need" includes those who received aid meeting or exceeding their calculated need; in past editions of this report these students were categorized as having "met" need or "overmet" need.

The study considered students who enrolled as full-time, first-time students in a four-year public college or university in fall 2008 after having graduated from high school within the previous 16 months; all students in the study applied for financial aid. Results from the 2013 study showed that unmet need was more prevalent among low-income students; approximately 70 % to 85% of students receiving financial aid whose family income fell within the lowest two quintiles (approximately

$65,000 or less) had unmet need. For these students, the percentage of their cost of attendance that was unmet surpassed 20%.

By contrast, no students whose family incomes were in the highest two quintiles had unmet need after receiving financial aid. In addition, the study showed that low-income students were more price-sensitive than higher-income students and that the size of the NCOA had a statistically significant, negative effect on both persistence and four-year degree completion for students in the lowest income quintile. Analyses of four-year graduation rates by income quintile found that only 22% of students in the lowest income quintile received a bachelor's degree in four years. The graduation rate of the second quintile was slightly better, at 29.7%. This compares with a 55.3% four-year graduation rate for students from families in the highest income quintile.

In 2014, a follow-up study on the same population of students was conducted to determine the relationship between the type of aid provided and four-year graduation rates. The study used the original 2013 population and compared students with and without loans. Results revealed that the more students borrowed, the higher their graduation rates. In particular, loans that moved students from having unmet need to overmet need appeared to increase graduation rates, especially for lower-income students (with family incomes below $62,000).

Overall, both studies showed that family income and unmet need have an effect on student graduation rates. The research suggested that student completion rates were positively affected by the presence of financial aid, and aid was especially powerful in assisting low-income students.

The present report provides further outcomes on the original cohort of students and advances the initial findings by looking at five- and six-year graduation rates. Specifically the following research questions guide this follow-up study: What is the relationship between students' unmet need and their five- and six-year graduation rates? How does NCOA at public four-year institutions affect the odds that a student will complete a degree in five or six years? Where appropriate, data from the original study regarding four-year outcomes are presented. These include graduation rates and the regression data from the original 2013 study (see Figure 1 in the report and Table 4 in the appendix).

Analysis

For this report, both descriptive analysis and logistic regression were used to understand the relationship between students' unmet need and their graduation outcomes and to examine the impact of NCOA on five- and six-year degree completion. The cohort for this analysis consisted of students who met the following criteria:

- First-time students in the fall of 2008 at a Maryland public four-year institution,
- Initially enrolled full-time in fall of 2008,
- Recent graduates from a Maryland high school in the previous year,
- Free Application for Federal Student Aid (FAFSA) completers, and
- Considered dependent as defined by the FAFSA.

The final analytic cohort (n) included 9,057 students. While roughly 48% of the students identified as white, approximately 35% indicated they were black or African American. Nearly 8% were Asian American, and 4% were Hispanic. The remaining 5% of the population identified as

unknown, biracial, foreign or another racial/ethnic group. Women comprised 56% of the students in the study.

All data for this study were obtained from MHEC's Enrollment Information System (EIS), Degree Information System (DIS), High School Graduate System (HGS), and Financial Aid Information System (FAIS) collections.

Descriptive Findings – Graduation Rates and Unmet Need

For the students in this study, graduation rates are tied to several factors, including students' income quintile, their level of financial aid support, and their unmet need. Figure 1 shows that as family income rises, the chances of graduating from college rise as well. This is seen most dramatically when comparing the six-year graduation rates for students from families in the highest income quintile to those in the lowest income quintile; approximately eight out of ten high-income students graduated from college in six years compared to five out of ten of the lowest income students. See Table 1 on page 6 for a list of all income quintiles.

Figure 1 also shows an increase in graduation rates for all income quintiles over time, with the greatest growth in rates occurring between year four and year five. For all income quintiles, the four- to five-year graduation rate increased an average of 20.7%; the second and third quintiles saw a slightly higher 21% to 23% jump. The graduation rate for students in the lowest income quintile nearly doubled, jumping 19.9% percentage points in one year. Overall six-year graduation rates increased another 5.9% on average, with the lower-income students (Quintiles 1 through 3) gaining approximately seven percentage points.

The extended time to graduation may be a function of a number of factors, including the possibility that students changed majors during enrollment or shifted enrollment patterns (e.g., from full- to part-time or stopping out temporarily) to accommodate employment or personal life demands. Change in institution may also play a role in delayed graduation. A small share of the original population (289, or 3.2%) was enrolled in, or had graduated from, a Maryland community college by the sixth year.

Figure 1: Four-, Five- and Six-year Graduation Rates by Income Quintile
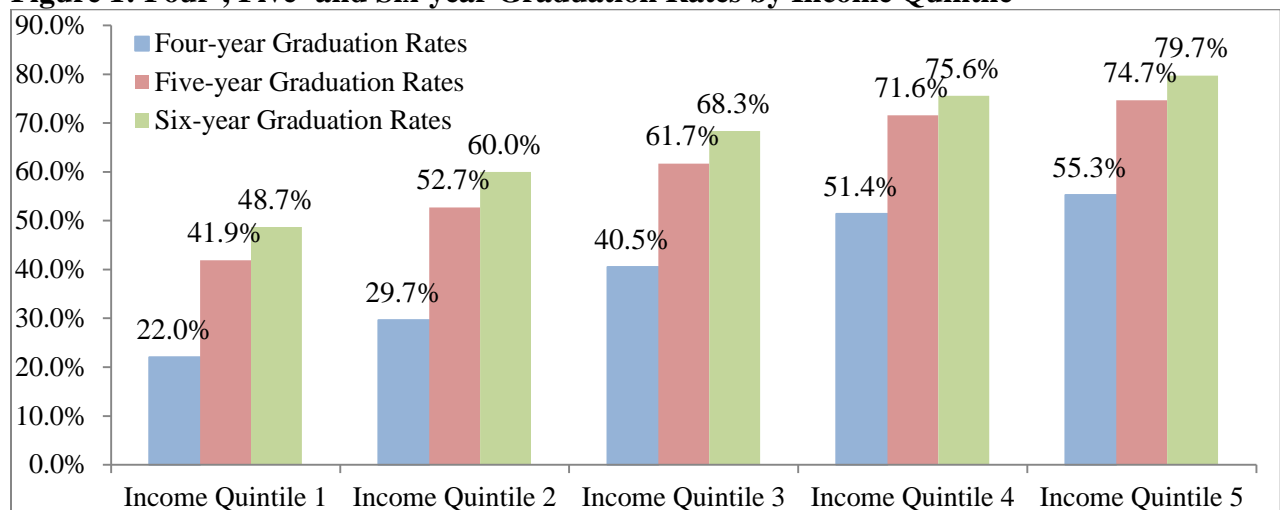
Figure 2 presents four-, five-, and six-year outcomes for those who did and did not have unmet need. The outcome at four years shows that approximately 40% of the students in the study had graduated, with the majority of graduates having no unmet need. Five-year outcomes show that a greater percentage of students graduated overall (60.5%), but two thirds of graduates were among those that had no unmet need. By the sixth year, over 66% of the students had graduated; again the majority of those graduates had all financial aid need met.

Figure 2: Four-, Five- and Six-year Graduation Rates – Students with Unmet/No Unmet Need
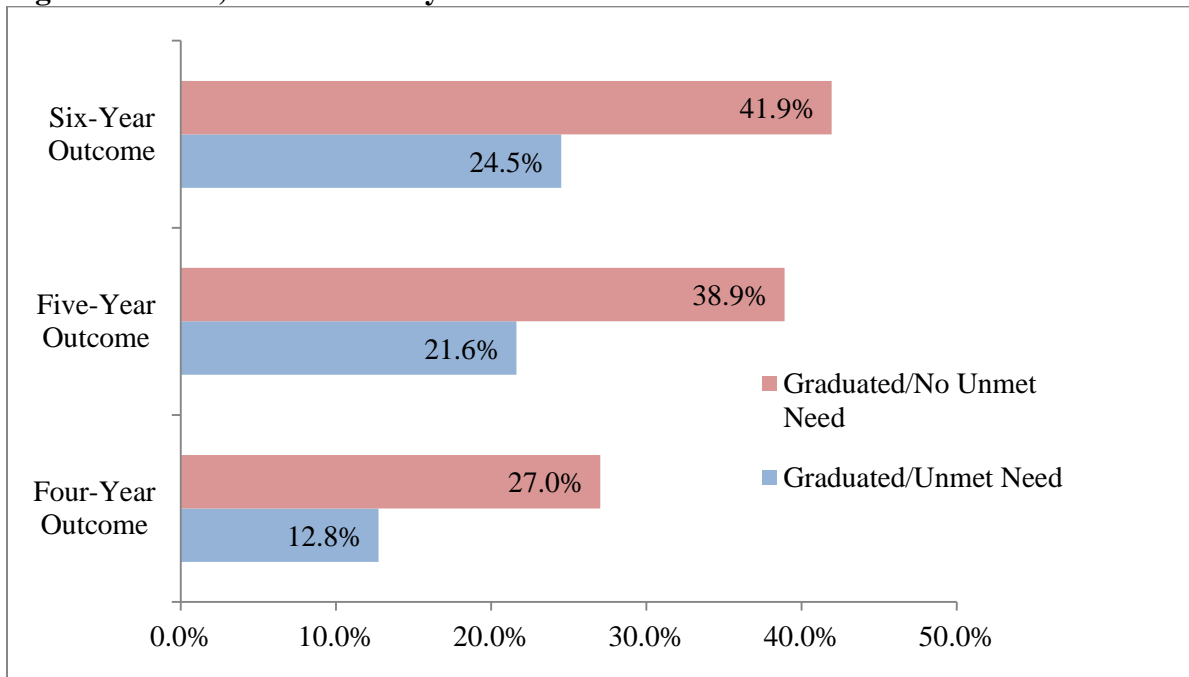
Dividing the student data by income quintile into those who had unmet need and those who had no unmet need shows graduation rate patterns that differentiate among income lines (see Figures 3 and 4). Figure 3 shows that, for students who had graduated by their fifth year, those within Quintiles 1 and 2 who had all need met graduated at higher rates than those with unmet need. These rates differ by approximately eight percentage points and suggest unmet need may have an effect on graduation rates. These differences in five-year graduation rate dissipate for those in Quintiles 3, 4 and 5, with those with unmet need and no unmet need graduating at similar rates. In fact, students in the highest quintiles with unmet need graduate at a slightly higher rate than those with no unmet need.

Figure 3: Five-year Graduation Rates by Income Quintile – Students with Unmet/No Unmet Need
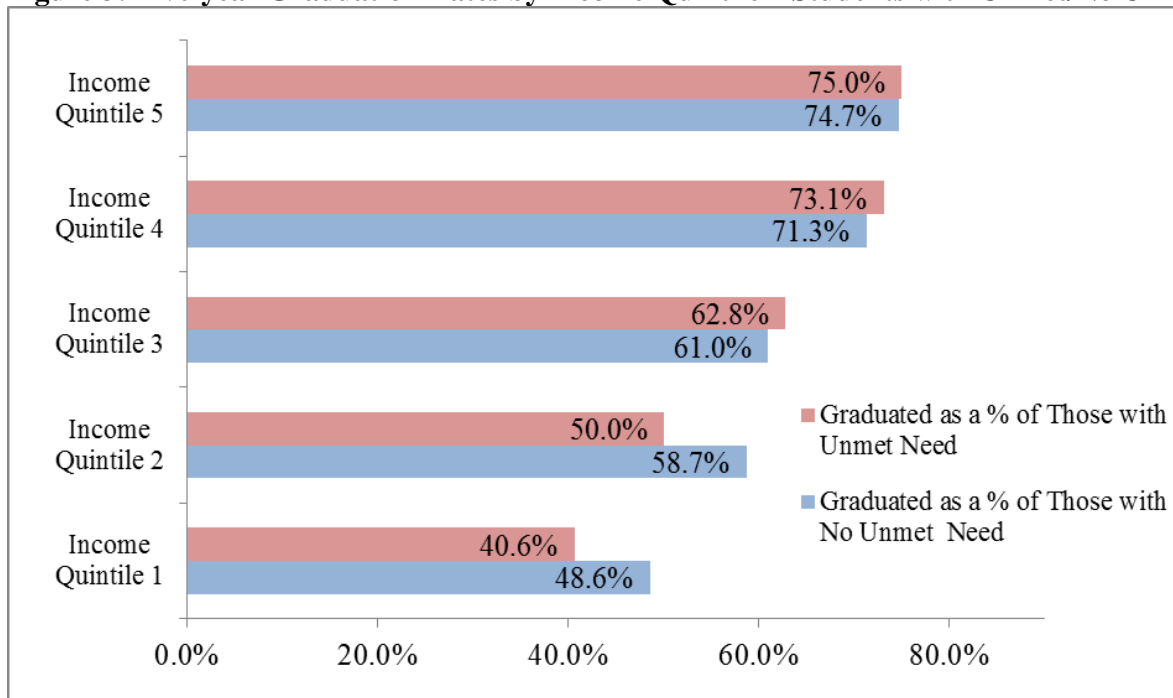
These patterns persist in six-year graduation rates by income quintile and unmet need/no unmet need (Figure 4). For those students in Quintiles 1 and 2, the gap in graduation rates for those with unmet need and those with no unmet need are approximately seven percentage points, with those with no unmet need graduating at higher rates. Again this pattern shifts in the higher income quintiles, with those with need graduating at the same rate or at slightly higher rates than those with no unmet need. These findings mirror the regression results found later in this paper, which show that the lower-income students' odds of graduating are significantly affected by the cost of attendance and amount of unmet need.

Figure 4: Six-year Graduation Rates by Income Quintile– Students with Unmet/No Unmet Need
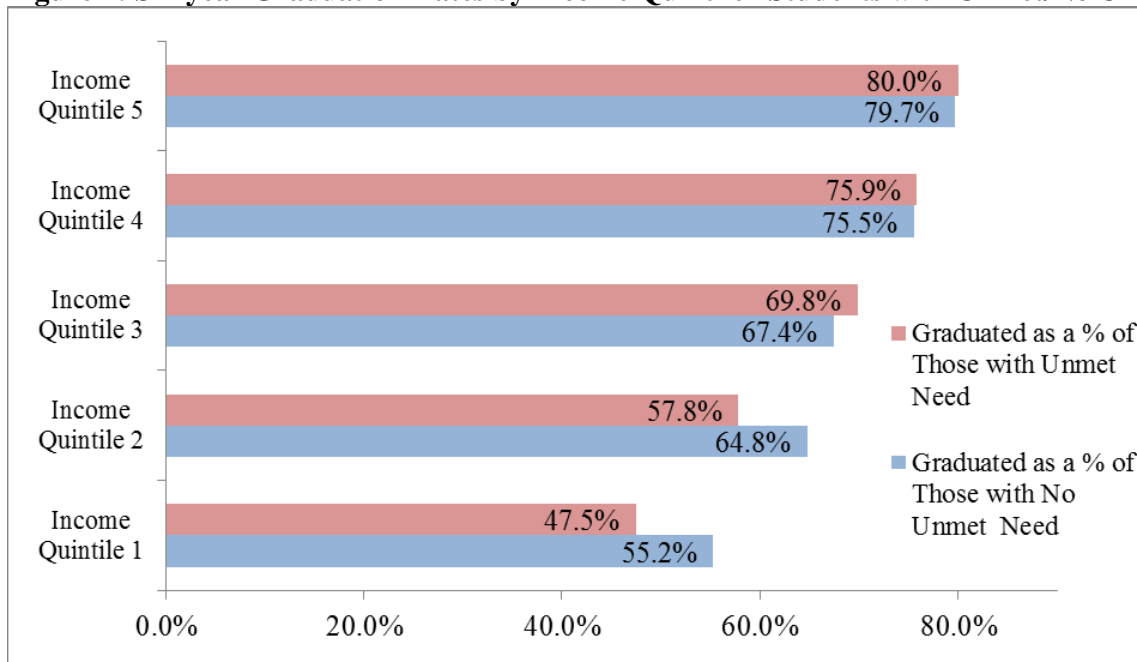
In sum, the data show that although low-income students generally persist to graduation at lower rates than their higher income peers, low-income students are more likely to see improvements in graduation rates if they receive sufficient financial aid. Students in lower income quintiles appear to be more sensitive to unmet need and more responsive to increased financial aid. A student in Quintile 1 who receives sufficient financial aid has the same graduation rate as students in Quintile 2, and a student in Quintile 2 who receives sufficient financial aid has the same graduation rate as students in Quintile 3.

The next section will present data on differences in cost of attendance, financial aid, and unmet need by students' income quintile.

Descriptive Findings - Costs, Aid, and Need

Table 1 presents data on family income, NCOA, the expected family contribution, and unmet need. As noted on page 1, NCOA is the net cost of attendance after all aid is applied, including grants, scholarships, loans, and work study. A student with an NCOA of $0 is able to meet all costs

through a combination of financial aid and family assets. A student with a negative NCOA has no unmet need and is receiving more aid than the cost of attendance.

The data show that approximately 42% of all students receiving some form of financial aid are unable to pay the cost of attendance after all financial aid and the EFC are taken into consideration. The unmet need (Column E) is the gap between the cost of attendance and the aid and family contribution. Over 80% of lowest-income students (Quintile 1) have unmet need compared to their peers from the highest-income quintiles (Quintile 5). This discrepancy is due, in large part, to the fairly high family income (and corresponding high EFC) of students in the top quintile.

Table 1: Net Cost of Attendance, Expected Family Contribution, and Unmet Need by Income Quintile and All Students

Income Quintiles	A (n)	B Average Family Income	C AVG Net COA	D AVG EFC	E AVG unmet need	F # with need (need>$0)	G % with need
Q1:Income <= $33,467	1807	$ 15,765	$ 6,126	$ 1,573	$ 4,553	1521	84.2%
Q2: Income > $33,467 <= $65,513	1811	$ 49,026	$ 8,094	$ 5,194	$ 2,900	1249	69.0%
Q3: Income > $65,513 <= $100,742	1813	$ 83,145	$ 9,917	$ 13,641	$ (3,724)	683	37.7%
Q4:Income > $100,742 <= $143,646	1813	$ 120,731	$ 11,485	$ 24,949	$ (13,464)	290	16.0%
Q5:Income > $143,646	1813	$ 205,961	$ 14,621	$ 47,225	$ (32,605)	100	5.5%
All Students	9057	$ 94,988	$ 10,051	$ 18,531	$ (8,479)	3843	42.4%

When comparing average family income to average unmet need by quintile, it is evident that for lower-income students a large portion of the family's income could be consumed by the student's unmet need. For example, students in the lowest income quintile would have to use, on average, 29% of their families' income ($4,553/$15,765) to cover the unmet need. By contrast, the majority of students in Quintiles 3, 4, and 5 do not have, on average, any unmet need, and a combination of parental contribution, scholarships, and loans can cover all costs.

Table 2 provides greater analysis of the methods by which students cover the costs of their education. Overall trends show that those students in the lowest quintile cover the majority of their cost of attendance through grants, which include Pell grants and state need-based aid. Loans provide additional aid, and family contributions help, but these students still face an unmet need gap of 22%. For the average family in the lowest income quintile, this means $4,482 of unmet need.

Table 2: Percentage of COA covered by Loans, Grants, Scholarships, Work-study, and Expected Family Contribution by Quintile

A Income quintiles	B (n)	C AVG COA	D % of COA met with loans	E % of COA met with grants	F % of COA met by EFC	G % of COA met by Scholarships	H % of COA met by Work Study	I % of COA Unmet
Q1:Income <= $33,467	1807	$ 20,375	19%	42%	8%	8%	1%	22%
Q2: Income > $33,467 <= $65,513	1811	$ 21,119	27%	25%	25%	10%	0%	14%
Q3: Income > $65,513 <= $100,742	1813	$ 21,591	35%	8%	63%	11%	0%	NONE
Q4:Income > $100,742 <= $143,646	1813	$ 22,761	35%	2%	110%	13%	0%	NONE
Q5:Income > $143,646	1813	$ 24,783	26%	1%	191%	14%	0%	NONE

For students in the remaining quintiles (Quintiles 2 through 5), loans constitute the largest portion of the financial aid applied to the cost of attendance. These students are using loans to pay for 27% to 35% of their college costs on average. Average loan amounts for students in these quintiles run between $5,741 and $7,866, which exceeds the average scholarship and grant awards these students receive.

Students with financial aid in the form of loans were a focus of the 2014 Report on Unmet Need and Student Success at Maryland Public Four-Year Institutions, and findings revealed that loans, in and of themselves, have less impact on student success than family income and unmet need. In fact, findings suggested that loans had a positive impact on graduation if the loan amount was applied to the gap in the student's unmet need, moving the student toward having overmet need.

Descriptive Findings – Grade Point Average

When the population of students in the study is divided into grade point average (GPA) quintiles, and graduation rates by GPA quintile are calculated, those students with higher first-year cumulative GPAs have a higher six-year graduation rate. Table 3 shows that only 23.1% of students with a first-year GPA of 0 to 2.13 graduated within six years; the rate more than doubles for those in the next GPA quintile (2.14 to 2.69). The graduation rates plateau slightly for the remaining three GPA quintiles, increasing 15.9 percentage points from Quintile 3 to Quintile 5 (76.3% to 92.2%).

Table 3: Graduation Rates by GPA Quintile for those with Unmet Need and No Unmet Need							
A	B	C	D	E	F	G	H
GPA Quintile	(n)	# who graduated in 6 years	Graduation rate by GPA quintile	Graduated with unmet need	% of graduates with unmet need	Graduated with no unmet need	% of graduates with no unmet need
Q 1: 0 to 2.13	1824	422	23.1%	197	46.7%	225	53.3%
Q 2: 2.14 to 2.69	1794	1045	58.2%	456	43.6%	589	56.4%
Q 3: 2.70 to 3.12	1859	1418	76.3%	553	39.0%	865	61.0%
Q 4: 3.13 to 3.52	1785	1500	84.0%	536	35.7%	964	64.3%
Q 5: 3.53 to 4.0	1769	1631	92.2%	476	29.2%	1155	70.8%

Note: GPA quintiles do not equal total population; 26 records had missing GPA data

Of the students who graduated within six years, differences in outcomes emerge when the students within each GPA quintile are divided by those who had unmet need and those who had no unmet need. The percentages of students with unmet need and no unmet need who graduated are fairly similar for those students within the first two GPA quintiles. For example, 197 (or 46.7%) of the 422 graduates in Quintile 1 had unmet need compared to the 225 (or 53.3%) who had no unmet need).

But differences arise when comparing the academically stronger students. Of the 1,418 students with a 2.70 to 3.12 GPA who graduated within six years, only 39% of graduates had unmet financial need compared to 61% of graduates who had no unmet need.

Most striking are the different outcomes when comparing the most academically talented students within GPA Quintile 5. Of the 1,631 students with a GPA between 3.53 and 4.0 who graduated in

six years, 70.8% had no unmet need, yet only 29.2% had unmet financial need. This means that, of the students with the highest GPAs, only 3 out of 10 students with unmet need graduated in six years compared to 7 out of 10 of those with no unmet need. These findings further support the conclusion that sufficient financial aid to meet or exceed need can improve graduation rates.

Further analysis of the students within each GPA quintile shows that there are differences in the composition of each GPA quintile by students' family income. Figure 5 shows that those in the lowest income quintile constitute 30.5% of the students in the lowest GPA quintile and only 9.2% of the students in the highest GPA quintile. Conversely, the students in the highest income quintile make up only 11.1% of the lowest GPA quintile and 30.3% of the highest GPA quintile. Figure 5 suggests that there is a correlation between income and academic performance, as measured by first-year cumulative GPA. Students at the higher income levels are significantly more likely than their low-income peers to have a GPA of 3.53 or above.

Figure 5: Percentage of Students from Each GPA Quintile within Each Income Quintile
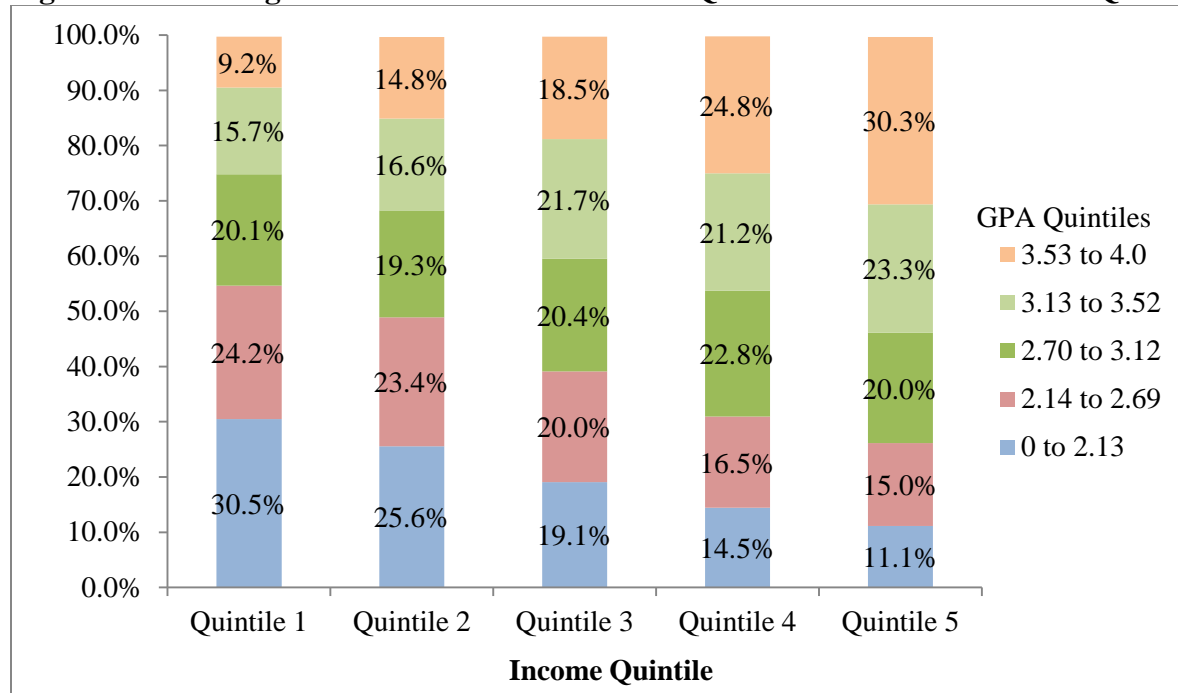
Perhaps most striking is that those students who perform the best academically (earning a cumulative GPA of 3.53 or higher in their first year) and who have unmet need are less likely to graduate than their academic peers who have no unmet financial need. This further supports this study's findings that differences in higher education outcomes can be affected by eliminating students' need through financial aid.

Logistic Regression Findings

In an effort to understand the effect of net cost of attendance on five- and six-year graduation rates, logistic regression was performed. The original population in this analysis consisted of 9,057 students who graduated high school in 2008 and subsequently enrolled full-time in a four-year

Maryland public college or university. All were FAFSA completers and were dependents. Of this original population, 408 records were dropped because of missing data. Of these, 382 were missing standardized test scores and 26 were missing cumulative GPA data. An analysis of the missing variables showed minor differences compared to the larger population but no significant variations were discovered. Therefore, no further imputations were done. The regression was performed on 8,649 valid records. The records were grouped by the same family income quintiles used in Table 1.

The logistic regressions modeled the same set of independent variables used in the original 2013 study. These were selected with an assumption that they may have an effect on students' completion. The regression analysis included the following variables:
- Net cost of attendance (NCOA)
- Cumulative first-year GPA
- Standardized test scores
- Female
- Declaration of a STEM major
- Expected family contribution

Population means, standard deviations, and definitions of the variables in the analysis are listed in Table 4 in the appendix. In addition, regression findings for the updated study accompany the original regression findings from 2013. [1] These can be found in Tables 5, 6, and 7 of the appendix.

Regression findings revealed that net cost of attendance in the first year of college enrollment was a statistically significant, negative predictor of five- and six-year graduation for students in the lowest two income quintiles (family incomes ranging from $0 to $65,513). See Tables 6 and 7 in the appendices for the regression data for these two outcomes. Looking at the data on six-year graduation rates for students in the lowest quintile, the odds ratio for NCOA was .961. Therefore, for every $1,000 decrease in the net cost of attendance, the odds of graduating in six years adjust positively by a factor of 1.03. Put another way, after controlling for other variables in the model, each $1,000-dollar decrease in the NCOA increases the odds of graduating by approximately 4% (1-.961*100=3.6). In other words, students in the lowest income quintile (whose average NCOA is $6,216) odds of graduating would increase by 6.3% if their NCOA was reduced to zero.

For students among all five quintiles, standardized test scores were also a predictor of six-year graduation but its odds ratio is overall fairly small, ranging from 1.08 to 1.22. Therefore, for every 100 point increase in standardized test scores, students' odds of graduating would increase by a factor of .82 to .92. In addition, being female was a significant predictor of six-year graduation for students within the third and fourth quintiles. The effect size (odds ratios) was on par with the effect size for NCOA and standardized test scores.

When looking at all income quintiles across the regression model and controlling for all other variables, cumulative GPA in the first year of college was a statistically significant, positive predictor of five- and six-year degree completion. The odds ratio for this variable was larger than

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[1] Data entry errors in the regression analysis were found in the 2013 Unmet Need and Student Success at Maryland Public Four-Year Institutions report completed by MHEC; corrected data is found in Table 4 within the appendix. The data entry errors do not alter the original study's findings.

the odds ratio for NCOA, standardized tests or being female, thereby indicating cumulative GPA had the greatest influence on five- and six-year graduation.

The logistic regression results support the descriptive findings, showing that an increase in GPA has a positive effect on graduation. It seems logical that first-year GPA would be a strong predictor of persistence to graduation, as grades are seen as a measure, in part, of motivation, work habits, and subject mastery. Yet, as the descriptive findings show, these positive effects on graduation provide a disproportionate benefit for those students who have no unmet need, for their graduation rates are consistently higher than those with unmet need.

Discussion

Limitations

There are several limitations worth acknowledging in this report. First and foremost, the regression incorporates data captured at one point in time — the students' first year. These data include financial aid awarded, parental income, grade point average, and calculated unmet need. These data on the students in this cohort likely altered over the course of the second year onward, but the size and scope of this study did not allow for the use of longitudinal data.

Second, these results reflect the outcomes of full-time, traditional-age students enrolling in one of Maryland's public four-year institutions and yet Maryland's college-going students also attend the state's community colleges and independent institutions. In addition, Maryland's higher education system supports a diverse body of students, many of whom are older, attend part-time and are employed. Therefore, the results from this study cannot be generalized to the broader Maryland college-going population.

Third, this report (like its predecessors) defines "need" as the difference between the cost of attendance as specified by the institution and the ability-to-pay of the student's family as calculated by the standard federal financial aid formula. Although this is a standard practice in evaluating financial aid and financial aid policy, it does not account for the ways that students and families perceive their own financial need.

Lastly, this study's logistic regression model's goodness-of-fit test results (Nagelkerke's R square) ranged from .291 to .392 for five-year graduation and .260 and .395 for six-year graduation. This means that approximately 29% to 39% of the variance in the independent variables is predicted by the five-year graduation model and 26% to 39% of the variance in the variables is predicted by the six-year model. These percentages indicate that there are factors that are unaccounted for influencing students' persistence to graduation other than those found in the model.

Conclusions

As college prices have risen over the past decades, so, too, has the amount of grants, scholarships, and loans made available to students. Regardless, many students still face sizeable gaps between the cost of attending college and aid available to pay for college. These students face difficult choices

regarding the means by which they fund the gap between college prices and aid available. An examination of the relationship between college prices, student financial need, and progress toward degree completion can further inform the discussion regarding college affordability.

This study sought to answer questions about the relationship between financial aid, unmet need, and graduation rates. The primary findings of the research suggest that five- and six-year graduation rates are affected by students' unmet need and family income; those from the lowest income families and with the greatest unmet need are the least likely to graduate. Regression findings reveal that increases in NCOA can have a significant negative effect on five- and six-year graduation rates of students from the lowest income families (those with family incomes between $0 and $65,513). Nevertheless, students in the lowest income brackets are the most likely to see graduation rates improve when they receive sufficient financial aid to meet their need.

These findings corroborate the 2013 and 2014 Reports on Unmet Need and Student Success at Maryland Public Four-Year Institutions by showing that meeting or overmeeting low-income students' unmet need through financial aid is an effective and efficient means by which to improve graduation rates. These reports also are consistent with findings from national studies showing that factors such as unmet need and rising college prices disproportionally affect degree completion for lower-income students.[2]

It is likely that students from low-income families face hurdles to completion that their higher-income peers do not face. These hurdles may include working part-time or full-time while enrolled or interrupting college for a semester or longer to focus on employment and saving money in order to return to school. Both these scenarios put students at risk of delayed graduation or leaving college altogether. The latter outcome is particularly troubling, as students who depart before graduation can be burdened with college debt and reap none of the economic rewards that come with a college degree.

In addition to the findings related to the effect of unmet need on degree completion, this study identified other factors tied to students' persistence. The most significant predictor of graduation for students from all income levels was cumulative grade point average; results reveal a positive relationship between grade point average and graduation. Standardized test scores were also a statistically significant positive predictor of completion for students in all income quintiles. Taken together, these results make sense: good grades allow students to progress toward graduation. Also, standardized test scores are seen as one measure of academic preparation and college readiness; therefore, students who are academically under- or unprepared are at risk of leaving college before graduation.

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[2] Bound, John, Michael F. Lovenheim, and Sarah Turner. *Increasing time to baccalaureate degree in the United States.* No. w15892. National Bureau of Economic Research, 2010.
Castleman, Benjamin L., and Bridget Terry Long. *Looking beyond enrollment: The causal effect of need-based grants on college access, persistence, and graduation.* No. w19306. National Bureau of Economic Research, 2013.
Titus, Marvin A. "Understanding college degree completion of students with low socioeconomic status: The influence of the institutional financial context." Research in Higher Education 47, no. 4 (2006): 371-398.

Recommendations

The results of this study and the two previous reports can inform state policy in the areas of financial aid and, to a lesser effect, college readiness.

Financial Aid
The gaps between college prices and aid for the lowest income students play a role in their lower graduation rates. This analysis suggests that state-level efforts to use financial aid to improve graduation rates for low-income students might be focused on increases in state funding for Maryland's Educational Assistance Grant and Guaranteed Access Grant programs. Increases to the overall pool of funds and alterations to the funding formula could reduce unmet need for the lowest income students.

This research also suggests that policymakers seeking ways to use financial aid dollars to increase student graduation rates should direct resources to meeting, or overmeeting, the financial need of the lowest income students. Students with higher family incomes are likely to find other sources of funds to ensure degree completion.

Results of this study also reveal that graduation rates for students in the lowest quintiles nearly doubled between years four and five. This suggests that students could benefit from policies that would ensure the eligibility of students to receive need-based aid in the fifth year of full-time study.

Additional research using longitudinal financial aid data could provide more insights about possible changes to financial aid policy.

Future research from the Commission will unpack further the effect of aid on student outcomes; longitudinal studies of community college students and students at public four-year institutions will be forthcoming in the coming months.

College Readiness and Performance
The regression analysis suggests that focusing on issues of college affordability and financial aid are not enough to address the problem of college completion for the lowest income students.

Since the strongest predictor of students' persistence to graduation was academic performance in the first year of college, it is imperative that students entering college are positioned well for success and that they receive strong support after enrolling in college. Descriptive data reveal that the students with the lowest grades are disproportionally from the lowest-income families, thereby facing greater barriers to completion than their higher-income peers.

Statewide initiatives at both the secondary and postsecondary levels, established through the College and Career Readiness and College Completion Act of 2013 and elsewhere, have the potential to have a great effect on Maryland's college completion agenda, but sustained focus is needed to ensure that those students most at risk of coming to college unprepared or underprepared have the tools necessary to persist successfully to graduation. MHEC will continue to analyze

college-readiness and college completion initiatives to identify those with positive effects on college completion.

APPENDIX

Table 4: Five- and Six-year Graduation Variable Minimum and Maximum Values, Means, Standard Deviations and Definitions

	Min	Max	Mean	SD	Definition
Dependent Variable					Coded 1 for graduated and 0 for not graduated
Five-year degree completion	0.00	1.00	0.61	—	
Six-year degree completion	0.00	1.00	0.67	—	
Independent Variables					
NCOA (in $1000s)	-10.56	46.57	10.05	8.12	Cost of attendance in 1st year minus all financial aid received
Cumulative 1st year GPA	0.00	4.00	2.77	0.87	Student's cumulative GPA in first year
SATs (in 100s)	5.10	16.00	10.88	1.97	SAT test score (ACT scores transformed to SAT equivalent scores)
Female	0.00	1.00	0.56	—	Coded 1 for female and 0 for male
STEM Major	0.00	1.00	0.26	—	Coded 1 for STEM major and 0 for all other majors
EFC (in $1000s)	0.00	99.00	18.53	21.06	Annual amount of $ a family/student is expected to contribute to educational costs

Table 5: Binary Logistic Regression Model Results for Four-year Degree Completion (NCOA)

Variables	1st quintile			2nd quintile			3rd quintile			4th quintile			5th quintile		
	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.
NCOA (in $1000s)	0.969	*	0.01	0.97	**	0.01	1.01		0.01	1.00		0.01	1.01		0.01
EFC (in $1000s)	1.001		0.01	1.00		0.01	0.99		0.01	1.00		0.00	4.41		0.10
STEM major	0.795		0.17	0.80		0.15	0.77		0.14	0.82		0.14	1.29		0.04
Female	1.415	*	0.15	1.69	***	0.14	1.34	*	0.12	1.83	***	0.12	1.42	**	0.12
Cumulative 1st Year GPA	5.091	***	0.13	5.18	***	0.12	4.92	***	0.11	4.97	***	0.11	0.86	***	0.13
Standardized Test (in 100s)	1.366	***	0.04	1.35	***	0.04	1.29	***	0.04	1.33	***	0.04	1.00	***	0.00
Cases in analysis			94.0%			95.1%			95.1%			95.8%			97.4%
Nagelkerke R Square			0.36			0.39			0.37			0.40			0.35
Correctly Classified			80.8%			76.9%			74.2%			73.9%			73.6%
Null Model Correctly Classified			77.8%			70.2%			59.4%			51.6%			55.7%

Exp(B) = Odds Ratio; Sig = Statistical Significance (*** $p \le 0.001$, ** $p \le 0.01$, * $p \le 0.05$); S.E. = Standard Error

Table 6: Binary Logistic Regression Model Results for Five-year Degree Completion (NCOA)

Variables	1st quintile			2nd quintile			3rd quintile			4th quintile			5th quintile		
	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.
NCOA (in $1000s)	0.964	***	0.011	0.972	**	0.009	1.003		0.008	1.006		0.008	0.999		0.007
EFC (in $1000s)	0.994		0.012	1.001		0.010	1.004		0.007	0.999		0.005	0.999		0.003
STEM major	0.877		0.143	1.010		0.136	1.030		0.142	0.854		0.148	1.111		0.147
Female	1.187		0.125	1.419	**	0.121	1.364	*	0.123	1.724	***	0.135	1.194		0.132
Cumulative 1st Year GPA	4.695	***	0.097	4.383	***	0.093	4.930	***	0.098	4.862	***	0.104	4.049	**	0.100
Standardized Test (in 100s)	1.225	***	0.038	1.242	***	0.037	1.120	**	0.038	1.212	***	0.043	1.149	***	0.041
Cases in analysis			94.0%			95.1%			95.1%			95.8%			97.4%
Nagelkerke R Square			0.38			0.38			0.37			0.39			0.29
Correctly Classified			73.1%			75.5%			74.6%			80.5%			79.8%
Null Model Correctly Classified			58.1%			52.9%			61.6%			71.8%			75.2%

Exp(B) = Odds Ratio; Sig = Statistical Significance (*** $p \le 0.001$, ** $p \le 0.01$, * $p \le 0.05$); S.E. = Standard Error

Table 7: Binary Logistic Regression Model Results for Six-year Degree Completion (NCOA)

Variables	1st quintile			2nd quintile			3rd quintile			4th quintile			5th quintile		
	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.	Exp(B)	Sig.	S.E.
NCOA (in $1000s)	0.961	***	0.011	0.972	**	0.009	1.003		0.009	1.002		0.008	0.995		0.007
EFC (in $1000s)	0.990		0.012	0.994		0.010	0.998		0.007	0.999		0.006	1.001		0.003
STEM major	0.944		0.142	1.184		0.140	1.196		0.149	0.925		0.155	1.285		0.158
Female	1.166		0.124	1.175		0.123	1.387	*	0.128	1.512	**	0.140	1.070		0.140
Cumulative 1st Year GPA	4.637	***	0.093	4.541	***	0.092	5.056	***	0.099	4.937	***	0.105	3.829	***	0.101
Standardized Test (in 100s)	1.221	***	0.038	1.201	***	0.037	1.089	*	0.039	1.159	***	0.044	1.109	*	0.043
Cases in analysis	94.0%			95.1%			95.1%			95.8%			97.4%		
Nagelkerke R Square	0.40			0.38			0.37			0.38			0.26		
Correctly Classified	72.8%			76.1%			78.3%			82.3%			83.5%		
Null Model Correctly Classified	51.3%			60.2%			68.3%			75.8%			80.0%		

Exp(B) = Odds Ratio; Sig = Statistical Significance (*** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$); S.E. = Standard Error