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Remedial Coursework in Maryland: Examining Trends, High School Predictors, and College Outcomes

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Executive Summary

This report examined the trends in needing remedial coursework, the high school predictors of needing remedial coursework, and the college outcomes associated with needing remedial coursework in Maryland. Data from the Maryland Longitudinal Data System (MLDS) were used to link Maryland public high school graduate records to Maryland college enrollment and degree records. Sixty-seven percent of Maryland public high school graduates graduating in the 2013-2014 academic year who entered college in the 2014-2015 academic year were assessed for remedial coursework in any subject. Forty-one percent needed remedial coursework in any subject. Math was the most commonly assessed subject and was the subject in which students most commonly needed remedial coursework. Maryland two-year public institutions had the highest rates of students needing remedial coursework. Student demographic characteristics, high school program participation, high school attendance, and failing a high school assessment (HSA) were each associated with the likelihood of being assessed to need remedial coursework in college. Students assessed to need remedial coursework in college experienced more negative college outcomes when compared to students not assessed to need remedial coursework. These outcomes included poorer grades in the first non-remedial course taken, lower likelihood of earning a bachelor's degree, and increased time to degree. Additionally, a lower percentage of students beginning in a two-year college who were assessed to need remedial coursework eventually transferred to and earned their final degree from a four-year college when compared to students not assessed to need remedial coursework. This report concludes with policy implications and future directions for research on remedial coursework in Maryland.

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Introduction

Students who graduate from high school but are assessed to be unprepared for credit-bearing coursework upon enrolling in college need to enroll in remedial coursework. Remedial coursework assists students to develop the competencies they will need to succeed in higher education. Remedial courses are often non-credit bearing and must be taken in order to gain the necessary academic skills to enroll in the college credit-bearing course in that subject area. A recent report relying on transcript data and published by the National Center for Education Statistics (NCES) reported that 68% of students entering public two-year colleges and 40% of students entering public four-year colleges in 2003-2004 took at least one remedial course between 2003 and 2009 (Chen, 2016). These data suggest that a large number of students in the nation are graduating from high school not fully prepared for college-level coursework.

In this report we briefly review the existing research on remedial education, including the rates and trends, high school predictors, and the college outcomes associated with needing remedial coursework. We then use data from the Maryland Longitudinal Data System (MLDS) to examine the rates of Maryland high school graduates assessed to need remedial coursework at Maryland colleges. We also examine remedial coursework by academic subject, student demographic characteristics, and the characteristics of the colleges where remedial coursework was needed.

The longitudinal and cross-sector nature of the MLDS data provides a unique opportunity to answer research questions that otherwise would not be possible. First, the data of the MLDS link students' high school and college experiences, allowing us to examine the high school predictors of needing remedial coursework, including demographic characteristics, high school program characteristics, 12th grade attendance, and high school assessment (HSA) performance. Second, since the data of the MLDS now span seven years, we are able to examine the six year college degree outcomes of students who graduated from high school in 2008-2009 and enrolled in college in 2009-2010. We also examined transfer and time to college degree outcomes.

Background

National Rates of Needing Remedial Coursework

Across academic years, about 30-40% of college students need remedial coursework nationally (NCES, 2014; Rose, 2012). This percentage is much higher at two-year colleges where about 60-70% of students require remedial coursework (Chen, 2016; Rose, 2012). One potential explanation offered for the high rates of needing remedial coursework is the increase in the number of individuals attending college in recent decades when compared to prior decades. College students now include individuals who, thirty years ago, would not have thought college was possible or economically necessary (Rose, 2012). Another potential explanation is a

misalignment between the college readiness curriculum standards at the high school and college levels (Adelman, 2006; Bettinger & Long, 2009).

The rates of needing remedial coursework vary by characteristics of the college or university. Students who enter two-year colleges are more likely than equivalent students in four-year colleges to enroll in remedial coursework (Attewell, Lavin, Domina & Levey, 2006). Additionally, public institutions are more likely to require remedial coursework than private institutions (Attewell et al., 2006). The selectivity of the college or university is also important to consider when examining the rates of remedial coursework. Selectivity refers to the degree of difficulty for students to get admitted to the institution. Rates of needing remedial coursework are lower at more highly selective schools when compared to less highly selective schools (Attewell et al., 2006). This is largely because colleges have cutoff scores on standardized tests, above which students do not need to take the remedial assessment. In more selective colleges where students have higher standardized test scores, fewer students need to take the remedial assessment when compared to less selective colleges.

High School Predictors of Needing Remedial Coursework

Research indicates that student demographic characteristics are related to the probability of needing remedial coursework in college. In a nationally representative sample, African American students were more likely to take remedial coursework when compared to White students, even after controlling for academic preparation, family socio-economic status (SES), and type of high school and college attended (Attewell et al., 2006). In the same sample, 52% of students from the lowest SES quartile took remedial coursework compared to 24% of students from the highest SES quartile (Attewell et al., 2006). A second study also reported that Black students and students who ever received free and reduced price lunch had higher probabilities of enrolling in remedial coursework in North Carolina community colleges (Clotfelter, Ladd, Muschkin, & Vigdor, 2015). Clotfelter and colleagues (2015) also reported a higher probability of enrolling in remedial coursework for females when compared to males after controlling for other demographic characteristics.

Additionally, specific characteristics of a student's high school academic experience are related to the probability of needing remedial coursework in college. In a national study of public two-year and four-year college students, needing remedial coursework was associated with a composite measure of academic preparation that included high school grade point average (GPA), highest mathematics course taken in high school, and college admission test (Scholastic Aptitude Test [SAT] or the American College Testing [ACT] assessment) scores (Chen, 2016). The rates of needing remedial coursework also vary by course taking patterns. One study found that students enrolled in full-time courses of study in college required less remedial coursework than students enrolled in courses part-time (Bailey, Jeong, & Cho, 2010). Additionally, students who took calculus in high school or who started college with a major in science, technology, engineering, or mathematics (STEM) were less likely to take remedial coursework than students who did not take calculus and did not major in STEM (Radford, Pearson, Ho, Chambers, & Ferlazzo, 2012).

College Outcomes Associated with Needing Remedial Coursework

Research examining the outcomes associated with needing remedial coursework is mixed, likely due to the different samples and methodologies used across studies (Bettinger, Boatman, & Long, 2013). A study examining the outcomes of about 100,000 community college students in Florida reported that taking remedial coursework was associated with increased persistence and total number of college credits completed (Calcagno & Long, 2008). However, in this same study, taking remedial coursework was not associated with college degree completion (Calcagno & Long, 2008). Another study examining the outcomes of about 250,000 two-year and 200,000 four-year college students in Texas reported that taking remedial coursework had no association with total number of college credits attempted or college degree completion (Martorell & McFarlin, 2011). A study examining the outcomes of about 15,000 students in North Carolina community colleges reported that students required to take remedial coursework had lower probabilities of ever passing a college-level math or English course and had lower probabilities of college success when compared to students not required to take remedial coursework (Clotfelter et al., 2015). College success was defined as earning an associate degree, earning a diploma in an applied field, or passing at least 10 transferable courses within 4 years of the first term (see Clotfelter et al., 2015). A study using a nationally representative sample of two- and four-year college students reported that after controlling for family background and high school academic performance, students who initially entered two-year colleges and took remedial coursework were equally likely to complete degrees as students who initially entered two-year colleges and did not take remedial coursework (Attewell et al., 2006). In contrast, the same study reported that students who initially entered four-year colleges and took remedial coursework were less likely to complete degrees than students who initially entered four-year colleges and did not take remedial coursework (Attewell et al., 2006). More research on the outcomes associated with needing remedial coursework in college is needed to better understand whether taking remedial coursework is associated with positive or negative outcomes.

Research Questions

The analyses in this report use linked longitudinal data from the MLDS to answer two questions on the MLDS Center Research Agenda:

1. What percentage of Maryland high school exiters entering college are assessed to need to take developmental courses and in what content areas?
2. How likely are students placed in developmental courses to persist in postsecondary education and transfer and/or graduate?

Method

Data from the Maryland Longitudinal Data System (MLDS) were used to link student high school records to college enrollment and degree records. For this report, we examine

Maryland public high school graduates earning a regular high school diploma. Enrollments in college were limited to Maryland colleges and universities because the MLDS data contain remedial assessments only for Maryland institutions.

Maryland colleges offer remedial coursework at two-year and four-year institutions. Upon enrolling in a Maryland college, students who do not meet certain cutoff scores on the SAT or the ACT are required to take a placement exam to determine the proper level of coursework for their first semester of college. The most common placement exam used in Maryland is the Accuplacer from the College Board. However, some Maryland colleges use alternative placement exams. According to a recent policy paper published by the Maryland Department of Legislative Services, the community colleges in Maryland have adopted a common placement cutoff score to indicate college readiness (Halbach, 2015). However, four-year public colleges in Maryland do not have common placement cutoff scores (Halbach, 2015). In this report, we distinguish between students who were assessed for remedial coursework and students who were assessed to need remedial coursework. Students who met the exemption requirements for taking the placement exam were not assessed for remedial coursework upon entering a Maryland two-year or four-year college.

At the time this report was written, the most recent MLDS data available were for Maryland students who earned a regular high school diploma in the 2013-2014 academic year and enrolled in a Maryland college in the 2014-2015 academic year. This is the population used to study the rates in needing remedial coursework, the postsecondary institution type attended by students needing remedial coursework, the demographic characteristics of students needing remedial coursework, and the high school predictors of needing remedial coursework. The earliest available data for remedial assessments were for the 2008-2009 Maryland high school graduates enrolling in a Maryland college in the 2009-2010 academic year. This is the population used to examine the college outcomes associated with needing remedial coursework. By using the earliest cohort, we had enough longitudinal years of data to examine degree outcomes six years post-college enrollment.

Findings

Rates of Needing Remedial Coursework in Maryland

Nearly 58,000 students graduated from Maryland public high schools with a regular high school diploma in the 2013-2014 academic year. Of those students, nearly 30,000 enrolled in a Maryland college in the 2014-2015 academic year. Table 1 displays the percentage of that population who was assessed for remedial coursework and was assessed to need remedial coursework in any subject (math, English, or reading). Sixty-seven percent of 2013-2014 high school graduates entering college in academic year 2014-2015 were assessed for remedial coursework in any subject and 41% needed remedial coursework in any subject. The percentage of Maryland students being assessed for and needing remedial coursework in any subject has declined over time. For the 2008-2009 high school graduates entering college in

academic year 2009-2010, 74% were assessed for remedial coursework in any subject and 49% needed remedial coursework in any subject (see Appendix A).

Table 1. Percentage of High School Graduates (2013-2014) Enrolling in a Maryland College (2014-2015) Assessed for Remedial Coursework and Assessed to Need Remedial Coursework by High School District

	Assessed	Needed
	%	%
Total	67	41
Allegany	86	51
Anne Arundel	70	42
Baltimore	64	43
Baltimore City	70	56
Calvert	67	36
Caroline	69	45
Carroll	68	38
Cecil	77	69
Charles	72	48
Dorchester	68	51
Frederick	65	32
Garrett	83	49
Harford	72	36
Howard	59	23
Kent	76	60
Montgomery	67	34
Prince George's	71	55
Queen Anne's	64	36
Somerset	62	51
St. Mary's	70	42
Talbot	66	38
Washington	71	48
Wicomico	60	44
Worcester	58	38

The percentage of high school graduates who enrolled in a Maryland college and were assessed to need remedial coursework in any subject varied by high school district, with a low of 23% and a high of 69%. The percentage of high school graduates assessed to need remedial coursework in each district is a function of the percentage of students attending community colleges, the percentage going to college out-of-state (because this report does not include remedial assessments for out-of-state enrollments), etc.

Table 2 displays the percentage of high school graduates in academic year 2013-2014 enrolling in a Maryland college in academic year 2014-2015 who were assessed for remedial coursework and who were assessed to need remedial coursework by subject area. Here, students may have needed remedial coursework in more than one subject, and some students needed remedial coursework in all three subjects. Math was the subject with the highest percentage of students who were assessed (65%) and needed (37%) remedial coursework. Fifty-six percent of students were assessed and 18% of students needed remedial coursework in English. Fifty-two percent of students were assessed and 18% of students needed remedial coursework in reading.

Table 2. Percentage of High School Graduates (2013-2014) Enrolling in a Maryland College (2014-2015) Assessed for Remedial Coursework and Assessed to Need Remedial Coursework by Subject Area and High School District

	Math		English		Reading	
	Assessed	Needed	Assessed	Needed	Assessed	Needed
	%	%	%	%	%	%
Total	65	37	56	18	52	18
Allegany	81	45	81	26	78	21
Anne Arundel	67	40	61	8	59	11
Baltimore	60	40	54	20	53	19
Baltimore City	69	54	61	35	59	36
Calvert	63	29	58	19	56	11
Caroline	68	39	60	28	11	≤10
Carroll	65	35	58	15	58	14
Cecil	77	29	73	36	72	66
Charles	70	40	64	28	63	21
Dorchester	68	49	63	25	14	≤10
Frederick	61	26	55	12	50	11
Garrett	83	43	75	13	75	28
Harford	69	27	65	20	64	17
Howard	55	20	39	9	38	11
Kent	71	48	67	45	≤25	≤25
Montgomery	65	32	48	14	46	14
Prince George's	69	53	61	22	56	27
Queen Anne's	60	28	58	16	24	≤5
Somerset	61	47	52	16	52	16
St. Mary's	63	33	66	27	65	18
Talbot	64	37	63	24	≤10	≤10
Washington	70	45	63	32	9	2
Wicomico	57	41	47	18	46	13
Worcester	56	36	50	13	48	11

Figure 1 displays the percentage of high school graduates in academic year 2013-2014 enrolling in a Maryland college in academic year 2014-2015 who were assessed to need remedial coursework by subject area. Here, students were placed into categories based on the subject areas in which they were assessed to need remedial coursework. The largest percentage of students (42%) was assessed to need remedial coursework in math only. The next largest percentage of students (27%) was assessed to need remedial coursework in math, English, and reading.

Figure 1. Percentage Breakdown of High School Graduates (2013-2014) Enrolling in a Maryland College (2014-2015) Determined to Need Remedial Coursework by Subject Area

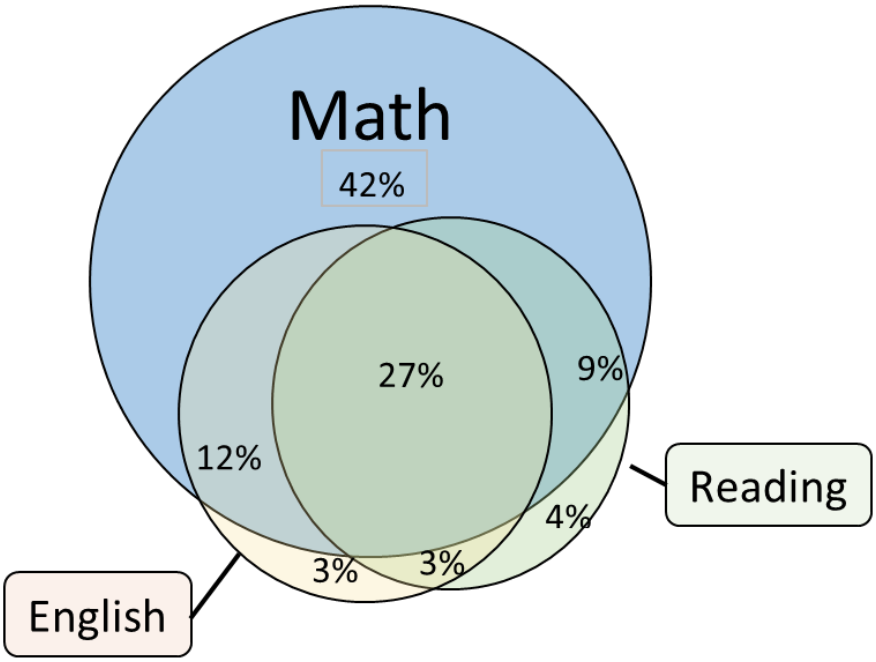


Table 3 displays the percentage of high school graduates in academic year 2013-2014 enrolling in a Maryland college in academic year 2014-2015 who were assessed for remedial coursework and who were assessed to need remedial coursework in any subject (math, English, or reading) by postsecondary institution type. Maryland two-year public institutions had the highest percentage of Maryland high school graduates who were assessed (75%) and who were assessed to need (58%) remedial coursework. Sixty-two percent of Maryland high school graduates enrolling in Maryland four-year public institutions were assessed and 15% were assessed to need remedial coursework. Fifteen percent of Maryland high school graduates enrolling in Maryland four-year private institutions were assessed and 7% were assessed to need remedial coursework.

Table 3. Percentage of High School Graduates (2013-2014) Enrolling in a Maryland College (2014-2015) Assessed for Remedial Coursework and Assessed to Need Remedial Coursework in Any Subject by Institutional Characteristics		
	Assessed	Needed
	%	%
Total	67	41
Two-Year Public	75	58
Four-Year Public	62	15
Four-Year Private	15	7

Table 4 displays the demographic characteristics of high school graduates in academic year 2013-2014 enrolling in a Maryland college in academic year 2014-2015 who were assessed for remedial coursework and who were assessed to need remedial coursework in any subject (math, English, or reading). A greater percentage of male students (70%) were assessed for remedial coursework when compared to female students (66%). However, a greater percentage of female students (42%) were assessed to need remedial coursework when compared to male students (40%). Black students (70%), Asian students (70%), and other-race[1] students (69%) were assessed for remedial coursework at the highest rates. Sixty-five percent of white students were assessed for remedial coursework. Black students were assessed to need remedial coursework at the highest rate (54%). Asian students were assessed to need remedial coursework at the lowest rate (22%). Hispanic students were assessed for remedial coursework at only a slightly higher rate (69%) than non-Hispanic students (67%). However, Hispanic students were assessed to need remedial coursework at a higher rate (50%) than non-Hispanic students (40%). A higher proportion of students eligible for free and reduced price meals[2] (FARMs) were assessed for remedial coursework (70%) and were assessed to need remedial coursework (54%) when compared to students not eligible for FARMs (66% and 36%, respectively). A lower proportion of English learner (EL) students were assessed for remedial coursework (40%) and were assessed to need remedial coursework (28%) when compared to non-EL students (68% and 42%, respectively). A higher proportion of special education students were assessed for remedial coursework (71%) and were assessed to need remedial coursework (64%) when compared to non-special education students (67% and 40%, respectively).

[1] The “other-race” category includes students who were Hawaiian, Native American, and two or more races.

[2] Eligibility for free and reduced price meals (FARMs) is a proxy for socio-economic status (SES).

Table 4. Demographic Characteristics of High School Graduates (2013-2014) Enrolling in a Maryland College (2014-2015) Assessed for Remedial Coursework and Assessed to Need Remedial Coursework in Any Subject

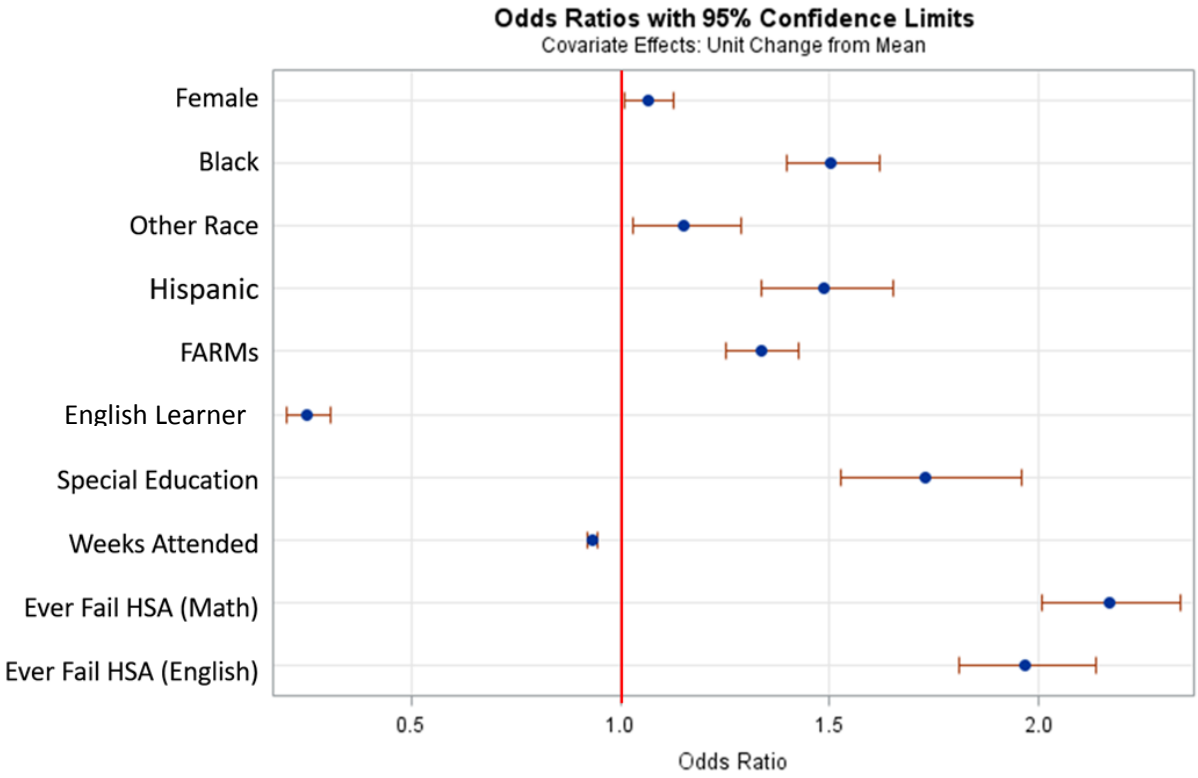
	Assessed %	Needed %
Total	68	41
Gender		
Female	66	42
Male	70	40
Race		
Black	70	54
White	65	35
Asian	70	22
Other	69	45
Ethnicity		
Hispanic	69	50
Not Hispanic	67	40
Free and Reduced Price Meals (FARMs)		
Farms	70	54
Not Farms	66	36
English Learner		
EL	40	28
Not EL	68	42
Special Education		
Special Ed	71	64
Not Special Ed	67	40

Note. Other race includes Hawaiian, Native American, and two or more races.

High School Predictors of Needing Remedial Coursework in Maryland

Figure 2 displays the results of a two-level (students nested within high schools) multilevel model used to assess the relation between student-level factors and the odds that a Maryland high school graduate would be assessed to need remedial coursework when enrolling in a Maryland college. Multilevel modeling (MLM) is the recommended technique for analyzing data when the experiences of subjects within groups are not independent of one another. For example, this approach is preferred when student academic outcomes are likely influenced by the unique features of the high school they attended (Raudenbush & Bryk, 2002). More information about the modeling procedure, model fit, and the results of the final model can be found in Appendix B.

Figure 2. Two-Level Model Predicting Need for Remedial Coursework in College



The odds ratios (*OR*) and corresponding 95% confidence intervals (*CI*) for the final model are presented in Figure 2. For each variable in the model, the *OR* is represented by a dot and the *CI* is represented by a horizontal line. If the line representing the *CI* crosses the vertical line labeled "1.0", then the variable did not have a unique significant relation to the odds of being assessed to need remedial coursework ($p > .05$). If the *OR* and its confidence interval exceed one, the predictor was significantly related to increased odds of being assessed to need remedial coursework. If the *OR* and its confidence interval fall below one, the predictor was significantly related to lower odds of being assessed to need remedial coursework. Each *OR* should be interpreted as the *OR* for the specified predictor after controlling for all other predictors in the model.

Among Maryland high school graduates entering a Maryland college in the following year, female students had 7% higher odds of being assessed to need remedial coursework than male students after controlling for all other predictors in the model. Black and other-race students had 50% and 15% higher odds of being assessed to need remedial coursework than white students, respectively, after controlling for all other predictors in the model. Hispanic students had 49% percent higher odds of being assessed to need remedial coursework than non-Hispanic students after controlling for all other predictors in the model. Students who were eligible for FARMs had 34% higher odds of being assessed to need remedial coursework than

students not eligible for FARMs after controlling for all other variables in the model. English learner (EL) students had 75% lower odds of being assessed to need remedial coursework than non-EL students after controlling for all other variables in the model. Special education students had 73% higher odds of being assessed to need remedial coursework than non-special education students after controlling for all other variables in the model. Attending an additional week[3] of high school during students' 12th grade year was associated with a 7% decrease in the odds of being assessed to need remedial coursework after controlling for all other variables in the model. Students who ever failed a math or English HSA had 117% and 97% higher odds of being assessed to need remedial coursework, respectively, after controlling for all other variables in the model.

College Outcomes Associated with Needing Remedial Coursework in Maryland

Figure 3 displays the grade earned in the first non-remedial math course taken by students who were not assessed to need remedial coursework and students who were assessed to need remedial coursework. A higher percentage of students not assessed to need remedial coursework received an A (29%) or a B (31%) in their first non-remedial math course when compared to students who were assessed to need remedial coursework (16% and 24% respectively). A higher percentage of students assessed to need remedial coursework received a C (29%), D (15%), or F (17%) in their first non-remedial math course when compared to students who were not assessed to need remedial coursework (23%, 8%, and 9% respectively).

Figure 4 displays the grade earned in the first non-remedial English course taken by students who were not assessed to need remedial coursework and students who were assessed to need remedial coursework. A higher percentage of students not assessed to need remedial coursework received an A (33%) or a B (40%) in their first non-remedial English course when compared to students who were assessed to need remedial coursework (16% and 32% respectively). A higher percentage of students assessed to need remedial coursework received a C (26%), D (9%), or F (17%) in their first non-remedial math course when compared to students who were not assessed to need remedial coursework (16%, 4%, and 7% respectively).

Table 5 displays the percentage of 2007-2008 Maryland high school graduates enrolling in a Maryland two-year college in academic year 2008-2009 who transferred and earned their final degree from a four-year college. Here, we used the final degree earned by the student by academic year 2014-2015. A lower percentage of students who were assessed to need remedial coursework (13%) transferred and earned their final degree from a four-year school when compared to the percentage of students who were not assessed to need remedial coursework (27%).

[3] There are 180 mandatory days in the school year. School days were converted to weeks to make interpretation easier. Controlling for other variables in the model, a 12th grade student who attended 15 weeks of school would have 7% lower odds of being assessed to need remedial coursework when enrolling in college in comparison to a 12th grade student who attended 14 weeks of school.

Figure 3. Grade Earned in First Non-Remedial Math Course

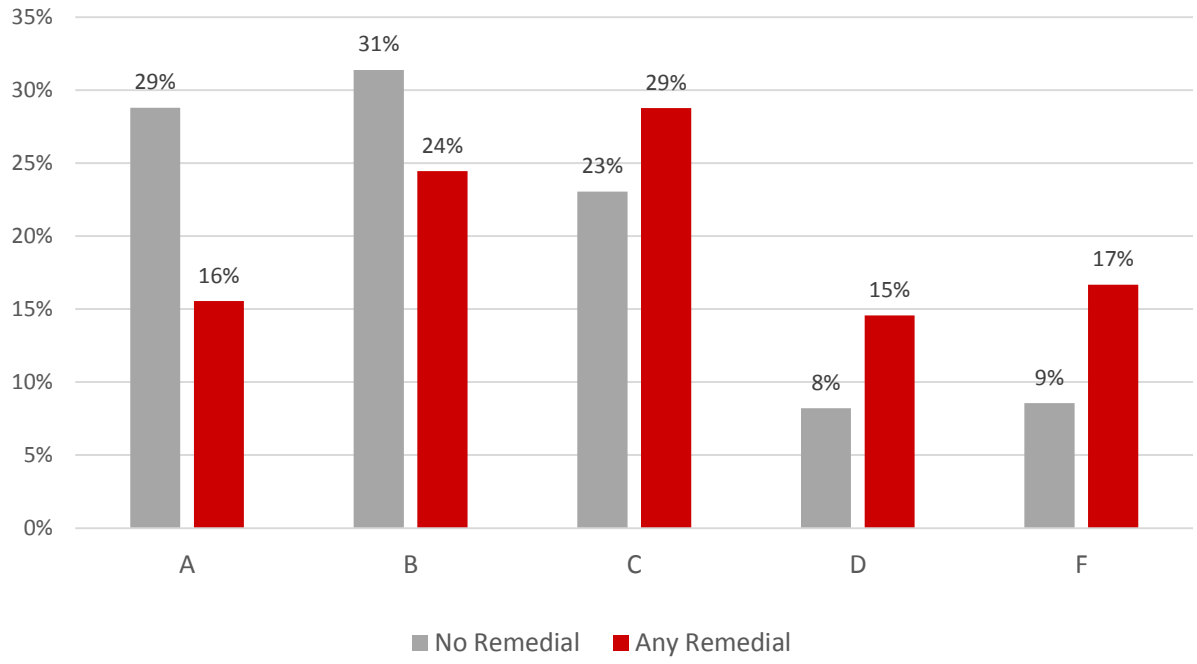


Figure 4. Grade Earned in First Non-Remedial English Course

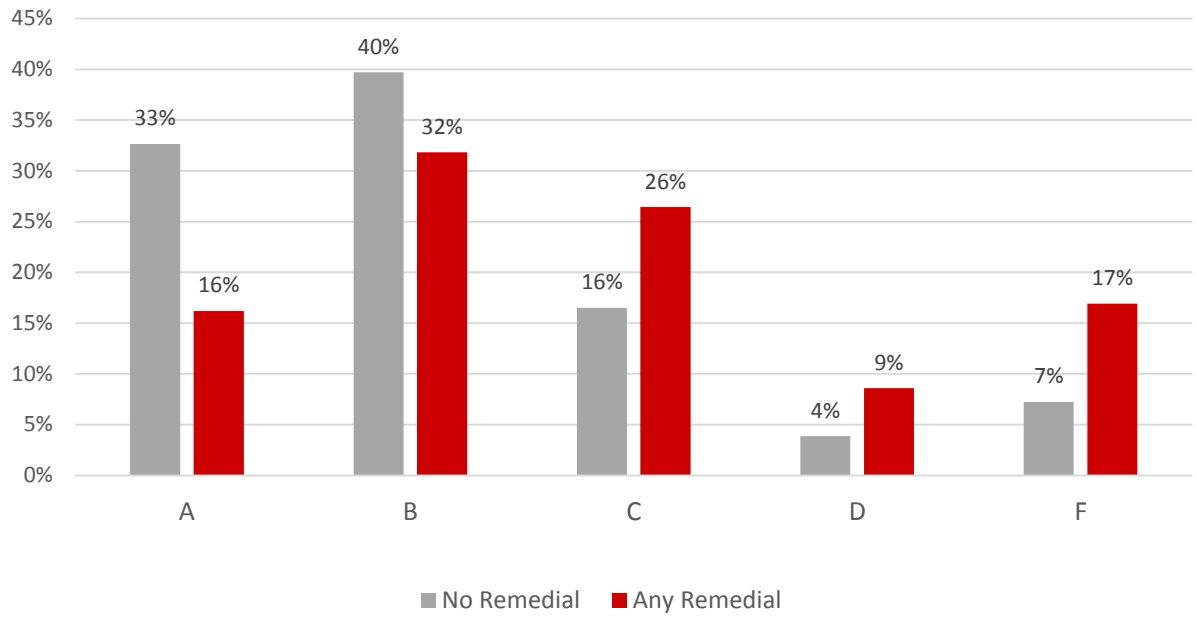


Table 5. Transfer Status of Students Entering Two-Year Colleges by Remedial Status			
		Needed Remedial Coursework	
	Total	No	Yes
	%	%	%
No Transfer to Four-Year	82	73	87
Transfer to Four-Year	18	27	13
Note. This table reports on data from 2007-2008 Maryland high school graduates enrolling in a Maryland two-year college in academic year 2008-2009. Transfer status was counted when the student earned their final degree from a four-year college.			

Table 6 diplays the percentage of 2007-2008 Maryland high school graduates enrolling in a Maryland college in academic year 2008-2009 who earned a certificate, associate, or bachelor's degree. Here, we used the final degree earned by the student by academic year 2014-2015. A higher percentage of students not assessed to need remedial coursework received any degree (61%) when compared to students assessed to need remedial coursework (33%). A higher percentage of students not assessed to need remedial coursework received a bachelor's degree (86%) as their final degree earned when compared to the percentage of students assessed to need remedial coursework (57%). A higher percentage of students assessed to need remedial coursework received a certificate (5%) or an associate degree (38%) as their final degree earned when compared to students not assessed to need remedial coursework (1% and 13% respectively).

Table 6. Final Degrees Earned by Remedial Status			
		Needed Remedial Coursework	
	Total	No	Yes
	%	%	%
Any Degree	47	61	33
Certificate	3	1	5
Associate	21	13	38
Bachelor's	76	86	57
Note. This table reports on data from 2007-2008 Maryland high school graduates enrolling in a Maryland two-year college in academic year 2008-2009.			

Table 7 displays the percentage of 2007-2008 Maryland high school graduates enrolling in a Maryland college in the 2008-2009 academic year who earned an associate or a bachelor's degree by number of years taken to complete the degree earned. Again, we used the final degree earned by the student by the end of the 2014-2015 academic year. For students who were assessed to need remedial coursework, the majority (76%) took 5-6 years to earn a bachelor's degree. Only 24% of students who were assessed to need remedial coursework earned a bachelor's degree in 4 years or less. For students not assessed to need remedial coursework, the majority (57%) earned a bachelor's degree in 4 years or less. A higher

percentage of students who were assessed to need remedial coursework earned an associate degree as their final degree earned in 5-6 years (44%) when compared to the percentage of students who were not assessed to need remedial coursework (37%).

Table 7. Time to Final Degree Earned by Remedial Status

		Needed Remedial Coursework	
		No	Yes
	Time to Achievement	%	%
Associate	1-2 Years	9	4
	3-4 Years	54	52
	5-6 Years	37	44
Bachelor's	1-4 Years	57	24
	5-6 Years	43	76

Note. This table reports on data from 2007-2008 Maryland high school graduates enrolling in a Maryland two-year college in academic year 2008-2009.

Summary of Findings

Sixty-seven percent of 2013-2014 high school graduates entering a Maryland college in academic year 2014-2015 were assessed for remedial coursework in any subject and 41% needed remedial coursework in any subject. These percentages varied by high school district. Math was the subject with the highest percentage of students being assessed and being assessed to need remedial coursework. Maryland two-year public institutions had the highest percentage of Maryland high school graduates who were assessed and who were assessed to need remedial coursework. Student demographic characteristics, high school program participation, high school attendance, and failing a HSA were each associated with the likelihood of being assessed to need remedial coursework. Students assessed to need remedial coursework received a C, D, or F in their first non-remedial courses at a higher rate than students not assessed to need remedial coursework. A lower percentage of students beginning in a two-year college who were assessed to need remedial coursework eventually transferred to and earned their final degree from a four-year college when compared to students not assessed to need remedial coursework. A lower percentage of students assessed to need remedial coursework received a bachelor's degree as their final degree earned, and students assessed to need remedial coursework took longer to complete their final degrees earned.

Discussion

The findings of this report are consistent with prior research on remedial coursework in a number of ways. First, consistent with prior research (Attewell et al., 2006), we found that students entering two-year colleges in Maryland were assessed to need remedial coursework at higher rates than students entering four-year colleges in Maryland. Second, consistent with prior research (Attewell et al., 2006; Clotfelter et al., 2015), we found that Black students and

students eligible for FARMs were more likely to be assessed to need remedial coursework in Maryland. Third, consistent with prior research (Chen, 2016), we found that characteristics of a student's high school experience (i.e., attendance and HSA performance) predicted being assessed to need remedial coursework upon enrolling in college in Maryland. The prior research on the college outcomes associated with needing remedial coursework has been mixed (Bettinger et al., 2013). Our findings indicated that being assessed to need remedial coursework was associated with more negative college outcomes in Maryland, including lower likelihood of earning a bachelor's degree as the final degree earned and increased time to earn a degree. These findings were consistent with those of Clotfelter and colleagues (2015) who examined the college outcomes of about 15,000 students in North Carolina community colleges.

Policy Implications

The high percentage of students being assessed to need remedial coursework in Maryland may indicate a potential misalignment between the rigor of high school courses and the expectations of college entry-level coursework. Making sure that college readiness curricula at the high school and college levels are well-aligned may help to reduce the percentage of Maryland students being assessed to need remedial coursework. Additionally, early identification of Maryland students at the highest risk for being assessed to need remedial coursework is important for targeting prevention and intervention services to lessen the need for remedial coursework in college. For example, our results indicated that students who failed a HSA were at high risk for being assessed to need remedial coursework. This population may benefit from additional prevention and intervention services in high school and throughout the transition to college.

Future Research

Future research on remedial coursework in Maryland using data from the MLDS will expand on the current report in a number of important ways. First, with more nuanced course-taking data at the high school and college levels, we will be able to examine how high school course taking patterns impact the need for remedial coursework and how college course taking patterns impact the college degree outcomes of students who were assessed to need remedial coursework. Second, with additional years of longitudinal data, we will be able to examine longer-term bachelor's degree outcomes. In this study, we were able to examine bachelor's degree outcomes up to six years after college enrollment. However, students who were assessed to need remedial coursework may take longer than six years to obtain their bachelor's degree. With additional years of longitudinal data, we will be able to examine these long-term degree outcomes. Third, future research will examine the workforce outcomes of students who were assessed to need remedial coursework in comparison to students who were not assessed to need remedial coursework. This research will answer important questions about the industries worked and the wages earned by students who were assessed to need remedial coursework in college.

Conclusion

This report examined the rates of assessment to need remedial coursework in Maryland, the high school predictors of needing remedial coursework in Maryland, and the college outcomes associated with needing remedial coursework in Maryland. The analyses for this report indicated that 41% of 2013-2014 high school graduates entering college in academic year 2014-2015 were assessed to need remedial coursework in any subject (math, English, or reading). Minority students and students eligible for FARMs were more likely to be assessed to need remedial coursework. Additionally, students who had failed a math or English HSA were more likely to be assessed to need remedial coursework. Overall, students who were assessed to need remedial coursework experienced more negative college outcomes when compared to students who were not assessed to need remedial coursework. These findings highlight the importance of early identification of students at risk for needing remedial coursework so that prevention and intervention services can be delivered to reduce the likelihood of negative college outcomes for this at-risk group of students.

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Appendix A

Table A.1
Percentage of High School Graduates (2008-2009) Enrolling in a Maryland College (2009-2010) Assessed for Remedial Coursework and Assessed to Need Remedial Coursework by High School District

	Assessed	Needed
	%	%
Total	74	49
Allegany	89	63
Anne Arundel	78	49
Baltimore	74	52
Baltimore City	73	64
Calvert	74	35
Caroline	78	47
Carroll	70	47
Cecil	79	54
Charles	78	42
Dorchester	77	63
Frederick	82	45
Garrett	80	61
Harford	75	60
Howard	70	33
Kent	78	44
Montgomery	78	43
Prince George's	62	48
Queen Anne's	82	45
Somerset	64	59
St. Mary's	76	34
Talbot	78	60
Washington	87	62
Wicomico	74	62
Worcester	71	57

Appendix B

Procedure and Results for Multilevel Model

First, an unconditional model was run to evaluate the extent of the variation in student outcomes that was due to differences between schools (Raudenbush & Bryk, 2002). The results, presented in Table B.1, indicated that the likelihood a student would be assessed to need remedial coursework varied between schools (z = 8.83, p <.0001). An intraclass correlation (ICC) of .109 was calculated using the covariance parameter intercept in Table B.1, indicating that 11% of the variation in the probability a student would be assessed to need remedial coursework could be attributed to between-school differences.

Table B.1
Results for the Unconditional Multilevel Logit Model Fitted to Evaluate the Degree of Variance in Remedial Course-Taking Due to Between-School Differences

					95% *CI*	
	B	*SE*	*t*	*p*	Lower	Upper
Fixed Effects [a]						
Constant	-.200	.045	-4.41	<.0001	-.290	-.111
Covariance Parameters						
Intercept (High School)	.394	.045	8.83 [b]	<.0001		

[a] The reference category is 1: Assessed to need remedial coursework
[b] Z-score

Next, a multilevel logit model was run that included a set of individual student predictors. Random intercepts were modeled. Random coefficients were not modeled. In order to evaluate whether the inclusion of additional predictors improved the fit of the model, -2 log likelihood, Akaike's Information Criterion (AIC) and Schwarz's Bayesian Information Criterion (BIC) were assessed (See Table B.2). All fit indices were lower in the final model when compared to the unconditional model, indicating that the inclusion of the student-level predictors in the final model resulted in a better fit to the data (Singer & Willett, 2003).

Table B.2
Model Fit Indices for Unconditional Means Model and Final Model Including Student-Level Predictors

	Unconditional Means Model	Final Model
-2 Log Likelihood	38318.79	33634.08
AIC	38322.79	33658.08
BIC	38329.66	33699.33

Note. AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion. Lower numbers indicate better model fit.

The results of the final model are presented in Table B.3. It is important to note that the results for each predictor control for all other predictors in the model.

Table B.3
Results for the Multilevel Logit Model Fitted to Evaluate the Contributions of Student-level Factors on the Odds of Being Assessed to Need Remedial Coursework

						95% *CI*	
	B	*SE*	*t*	*p*	*OR*	Lower	Upper
Fixed Effects [a]							
Intercept	1.435	.220	6.52	<.0001			
Female	.065	.027	2.38	.017	1.067	1.012	1.125
Black [b]	.407	.038	10.78	<.0001	1.503	1.395	1.618
Other Race [b]	.141	.057	2.50	.013	1.152	1.031	1.287
Hispanic	.397	.054	7.36	<.0001	1.487	1.338	1.653
FARMs	.290	.033	8.82	<.0001	1.336	1.253	1.425
English Learner	-1.390	.108	-12.94	<.0001	.249	.202	.307
Special Education	.547	.064	8.60	<.0001	1.728	1.526	1.958
Weeks Attended	-.068	.006	-10.75	<.0001	.934	.922	.946
Ever Fail HSA (Math)	.773	.039	19.88	<.0001	2.167	2.008	2.338
Ever Fail HSA (English)	.676	.043	15.86	<.0001	1.965	1.808	2.137
Covariance Parameters							
Intercept (High School)	.200	.025	7.99[c]	<.0001			

Note. Approximately 1,800 students were excluded from the final model due to missing data
a. The reference category is 1: Assessed to need remedial coursework
b. Compared to White students
c. Z-score