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Remedial Coursework in Maryland Community Colleges: Disentangling Individual and High School Level Predictors

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If you have questions regarding this publication, please contact mlds.center@maryland.gov.

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Executive Summary

Remedial courses at community colleges are designed to develop the skills of students who are underprepared for the academic rigor of college courses. A significant portion of students in Maryland and nationwide are assessed to need remedial coursework each year. In order to better prepare students for college courses and prevent the need for remediation, it is important to identify at-risk students before they arrive at college. This study used data from the Maryland Longitudinal Data System (MLDS) to examine the individual- and high school-level characteristics that predict the need for remediation in Maryland community colleges. The results indicate that after controlling for other characteristics, female students, Hispanic students, students in Special Education, and students who were eligible for free and reduced price meals (FARMS) were more likely to need remedial coursework in math or English at Maryland community colleges. After controlling for other characteristics, students who had a GPA of 3.0 or greater and students who took 2 or more courses with a grade of B or higher in high school were less likely to need remedial coursework in math and English. At the school level, after controlling for student-level characteristics, students who graduated from high schools with a higher percentage of students who were eligible for FARMS were more likely to need remedial coursework in math and English, whereas graduates from high schools with higher percentages of fifth-year graduates were less likely to need remedial coursework for math only. Policy implications and directions for future research are discussed.

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Introduction

Remedial coursework is designed to support students who are underprepared for credit-bearing coursework when entering college. Remedial courses typically do not count toward the fulfillment of degree requirements, rather, they provide the necessary academic skills to prepare students for coursework that does fulfill degree requirements. Nationally, 68% of first-year undergraduate students at public 2-year institutions and 40% of first-year undergraduate students at public 4-year institutions enrolled in a remedial course during academic year 2003-2004 (Chen, 2016). This suggests that a significant portion of high school graduates who enroll in college are not academically prepared for credit-bearing college courses.

Prior research using data from the Maryland Longitudinal Data System (MLDS) indicated that 41% of high school graduates (2013-2014) entering college during academic year 2014-2015 were assessed to need remedial coursework in Maryland (Henneberger, Uretsky, Klumpner, & Woolley, 2016). The rate of needing remedial coursework in Maryland community colleges (58%) was much higher than the rate in Maryland 4-year public (15%) and 4-year private (7%) institutions (Henneberger et al., 2016). Controlling for all other factors, female students, Black and other race students, Hispanic students, students who were eligible for free and reduced price meals[1] (FARMS), and special education students were more likely to need remedial coursework. English Learner (EL) students were less likely to need remedial coursework in college. In terms of academic performance, after controlling for demographic characteristics, students who attended an extra week of school during 12th grade were less likely to need remedial coursework and students who had ever failed a state standardized math or English assessment (high school assessment; HSA) were more likely to need remedial coursework (Henneberger et al., 2016).

Central to the goal of preventing the need for remedial coursework is the ability to identify at-risk students early in their academic careers in order to implement programs and policies to help them become ready for college coursework. Using data from the MLDS gave us the ability to examine high school predictors, providing the ability to identify at-risk students early in their academic careers. The current study builds on the prior study on remedial coursework in 2 main ways. First, this study focuses on high school graduates who enrolled in Maryland community colleges in the year following 12th grade. Students who enrolled in 4-year colleges are excluded from the study sample because most students who need remedial coursework are at community colleges and Maryland community colleges have a uniform cut point for determination of need for remedial coursework. Second, this study uses multi-level modeling (MLM; Raudenbush & Bryk, 2002) to examine the individual- and school-level predictors of needing remedial coursework. Individual predictors include demographic

[1] Eligibility for free and reduced price meals (FARMS) is used as a proxy for student socio-economic status (SES). Students are eligible for *free* meals if their household income was at or below 130 percent of the federal poverty level; students were eligible for *reduced-price* meals if their household income was between 130 and 185 percent of the federal poverty level (USDA, 2017, see https://www.fns.usda.gov/sbp/fact-sheet).

characteristics (e.g., gender, race, ethnicity), academic characteristics (e.g., attendance, grade point average [GPA] above 3.0), and program placement (e.g., eligibility for FARMS, special education, EL). School-level predictors include school demographic characteristics (e.g., percent of student body that is Black), school academic characteristics (e.g., percent of student body with a GPA above 3.0), and school program placement (e.g., percent of student body that is EL).

Background

The Importance of High School Context

High school-level characteristics, including demographic composition and academic opportunity, have a significant bearing on a student's college readiness (Adelman, 2006). Students spend a significant amount of time in school, and many aspects of that experience influence student outcomes. For example, smaller schools provide a different learning environment than larger schools due to variation in curricular and other resources as well as student and staff engagement. Research suggests that students who attend smaller schools have greater student achievement in high school and postsecondary education in general, and perform the same as or better than their peers from larger schools on college readiness measures (Cotton, 1996). Some high schools purposefully create a culture where college is the expectation for every student, and structure curriculum and resources for students accordingly. Students at these schools are considerably more likely to plan to attend college compared to students at schools where college-going behavior and preparation is not explicitly part of the norm (Roderick et al., 2008). When high school students are surrounded by a peer group that attends college, they are more likely to attend college as well (Roderick et al., 2008). The high school experience influences students academically and socially, and the context of a student's education can be a predictor of future performance.

Prior Research Linking the High School Context to Need for Remedial Coursework

Few studies directly link high school-level predictors to needing remedial coursework in college. The high school environment has been shown to impact overall student achievement, so it is logical to examine the need for remediation as a student outcome that is also influenced by school-level characteristics. Howell (2011) reported that for state postsecondary schools in California, students from high schools with higher rates of Black or Hispanic students had higher rates of college remedial course-taking. Academically, as the average SAT score of a high school increases, the likelihood of a student from that school needing remediation decreases (Howell, 2011). Hodara (2015) also found that school-level characteristics, such as the proportion of students with Individualized Education Programs (IEPs), influenced participation in remedial courses in college. The specific high school that a student attended was also found to be a significant predictor of the need for remediation (Hodara, 2015).

Prior research begins to highlight the importance of school-level demographic and academic characteristics for future need for remedial coursework. However, more research is needed that helps to disentangle the role of student and high school level predictors to help to determine the best ways to address the high levels of need for remedial coursework. If the

predictors of needing remedial coursework are primarily student-oriented, then tailoring early intervention to specific students in need may be a good use of State and local resources. However, if the predictors are primarily school-oriented, it may be helpful to look at school-level resources that may be provided to prevent the need for remedial coursework in college.

The Current Study

Relatively few studies have examined the high school-level predictors of needing remedial coursework. The current study provides an in-depth look at the individual- and school-level predictors of needing remedial coursework in Maryland community colleges. Disentangling the two will help guide State and local policymakers to determine whether student-oriented or school-oriented prevention may be the most useful. The sample is limited to Maryland public high school graduates who enter Maryland community colleges in the following academic year for a number of reasons. First, higher rates of students need remedial coursework in community colleges when compared to 4-year postsecondary institutions nationally (Chen, 2016) and in Maryland (Henneberger et al., 2016). Second, Maryland community colleges have a uniform cut point for determining students' need for remedial coursework, whereas Maryland 4-year postsecondary institutions set policies at the institution level. This study builds on the prior report published by Henneberger et al. (2016) to examine the importance of the high school context on the need for remedial coursework in Maryland community colleges.

Research Questions

This report responds to the Maryland Longitudinal Data System Center (MLDS) Center Research Agenda questions:

Are Maryland students academically prepared to enter postsecondary institutions and complete their programs in a timely manner?

What percentage of Maryland high school exiters entering college are assessed to need to take developmental courses and in what content areas?

Method

The data used for this report are from the Maryland Longitudinal Data System (MLDS), which contains linked longitudinal data from three State Agencies.[2] The Maryland State Department of Education (MSDE) provides data for public preK-12 students and schools. The Maryland Higher Education Commission (MHEC) provides data for Maryland public and private college students and colleges. Out-of-state college enrollments and degree data are obtained

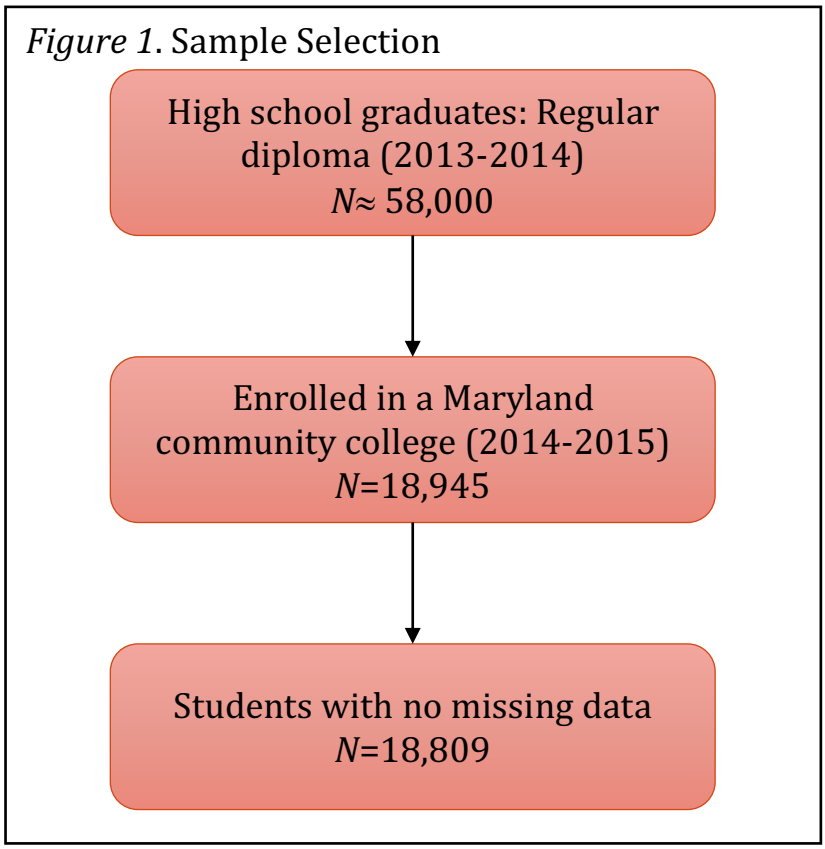
[2] For more information on the sources and data elements included in the MLDS, see https://mldscenter.maryland.gov/

through the National Student Clearinghouse (NSC)[3] for students who were in a Maryland public high school for the 12th grade.

Sample Selection

Maryland public high school students who earned a regular high school diploma in the 2013-2014 academic year and enrolled in a Maryland community college in the following academic year (2014-2015) were included for this study (see Figure 1). This selection criteria resulted in *N* = 18,945 students in 228 high schools who were included in the study sample. Students with complete data on all study variables included in this study were used for final analyses (*N* = 18,809).

Descriptive statistics for the sample can be found in Table 1. Fifty-two percent of the study sample was female, 50% was white, 13% was Hispanic, and 41% was eligible for free and reduced price meals (FARMS).



Measures

Student-level predictors included demographic characteristics, academic indicators, and program placement (see Table 1 for descriptive statistics and measurement descriptions for student-level predictor variables). Fifth year graduates were students who graduated high

[3] For more information, see http://www.studentclearinghouse.org/

school with a regular high school diploma in the 2013-2014 academic year, but who took 5 years to graduate[4]. *School-level predictors* were created by aggregating the individual student-level variables to the school-level for all 12th grade students attending each school in the 2013-2014 academic year (see Table 2 for descriptive statistics for school-level predictor variables). All school-level predictors, with the exception of attendance, were divided by 10 to improve the interpretability of results (Kline, 2011).

Table 1. Descriptive Statistics and Variable Measurement for Study Sample		
	Variable Measurement	%
Gender	Female (1); Male (0)	52
Race	White (1); Not white (0)	50
Hispanic	Hispanic any race (1); Not Hispanic any race (0)	13
English Learner (EL)	Reported by MSDE; 12th grade	6
FARMS Eligible	Reported by MSDE; 12th grade	41
Special Education	Reported by MSDE; 12th grade	9
GPA 3.0 or Above	Reported by MSDE at high school completion	30
Foreign Language Indicator*	Reported by MSDE at high school completion	41
Math Indicator*	Reported by MSDE at high school completion	29
Science Indicator*	Reported by MSDE at high school completion	18
Fifth-Year Graduate	Calculated using enrollment dates provided by MSDE	2
		Mean (SD)
Weeks Attended	Calculated using attendance data provided by MSDE	34 (4.7)
Note. FARMS = free and reduced price meals; *Indicates student took two or more classes in the subject with a grade of B or higher; *N* = 18,809 Maryland public high school students who earned a regular high school diploma in the 2013-2014 academic year and enrolled in a Maryland community college in the following academic year (2014-2015).		

Need for remedial coursework in Math and English at Maryland community colleges was categorized as yes (1) and no (0). Remedial courses in Maryland are offered at community colleges and 4-year colleges, and placement in those courses is generally determined by a placement test, which is administered to students who score at or below a certain SAT or ACT cutoff score. Students who met the exemption SAT or ACT requirements for taking the

[4] Fifth year graduates differ from prior work examining persisters (see Uretsky, Henneberger, & Woolley, 2016). A persister is a student who does not formally withdraw from high school, nor earn a regular high school diploma after attending four (and sometimes even five) years of high school. In contrast, fifth year graduates attended the fifth year of high school and graduated with a regular high school diploma. Persisters had negative college and workforce outcomes.

placement exam were not assessed for remedial coursework upon entering a Maryland community college and were coded as not needing remedial coursework in this study. Most institutions use the Accuplacer exam from the College Board for their placement exam, but others use an alternative exam. Maryland community colleges have agreed upon a common score on the placement exam to determine the need for remediation (Halbach, 2015).

Table 2. School-Level Descriptive Statistics (12th grade students)

	Mean	*SD*
% FARMS	50	27.54
% English Learner (EL)	4	5.09
% Fifth-Year Graduate	10	15.88
Weeks Attended	33	24.72

Note. FARMS = free and reduced price meals; *N* = 228 Maryland public high schools. School level descriptive statistics were calculated by aggregating the individual-level variables to the school level for 12th grade students only.

A total of 57% of the study sample was assessed to need remedial coursework in any subject (see Table 3). Of students who were assessed to need remedial coursework, 92% needed remedial coursework in math (see Table 3), with 40% needing remedial coursework in math only and an additional 52% needing remedial coursework in math and another subject (see Figure 2). There is a large amount of overlap in the students who need remedial coursework in English and reading, so further analyses using multilevel modeling will focus on students who need remedial coursework in English.

Table 3. Percentage of Students Needing Remedial Coursework by Subject Area

	Total Sample	Assessed to Need Remedial
	%	%
Any Remedial	57	-
Math	52	92
English	28	49
Reading	25	44

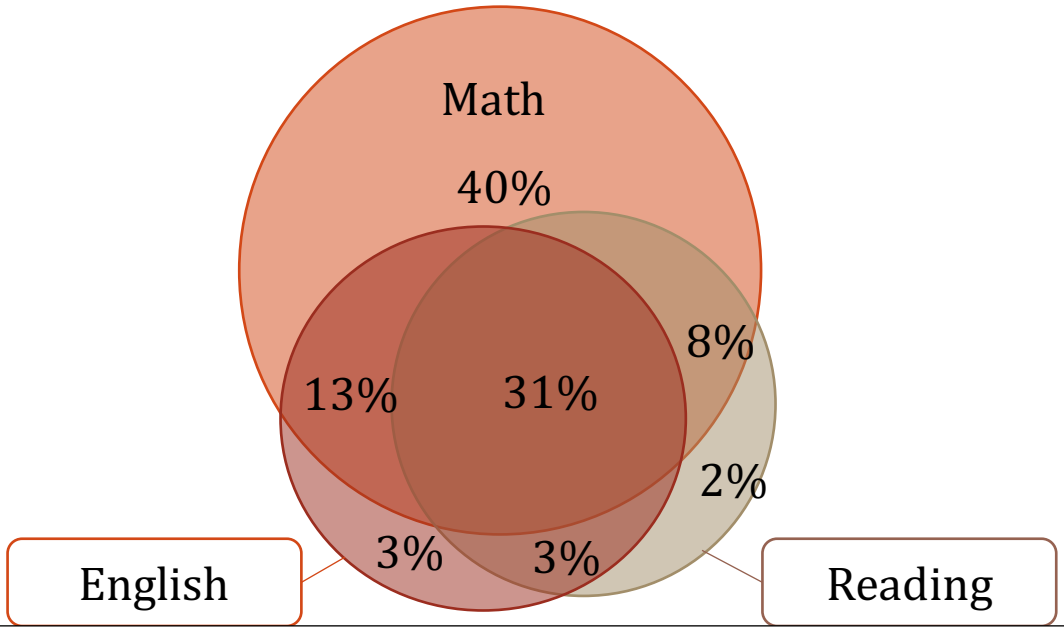
Note. Study sample includes Maryland public high school students who earned a regular high school diploma in the 2013-2014 academic year and enrolled in a Maryland community college in the following academic year (2014-2015).

Analyses. Multilevel modeling (MLM; Raudenbush & Bryk, 2002) was used to allow for the concurrent examination of the individual and school-level characteristics related to needing remedial coursework in Maryland community colleges. In this case, individual students are

considered at the first level and schools are considered at the second level. Students were nested in the school from which they graduated high school.

Analyses proceeded in a series of steps. First, an unconditional model was run to evaluate the extent of the variation in need for remedial coursework in math that was due to differences between schools. The results indicated significant variation between schools (intraclass correlation coefficient [ICC] = 0.08), indicating that 8% of the variation in the probability that a student would be assessed to need remedial coursework could be attributed to between-school differences. Next, a multilevel logit model predicting need for remedial coursework was run including student and school-level predictors. All continuous predictors at the individual and school levels were grand mean centered. Random intercepts were modeled and coefficients were fixed. Model fit was examined using -2 log likelihood, Akaike's Information Criterion (AIC) and Schwarz's Bayesian Information Criterion (BIC). All fit indices were lower in the final model when compared to the unconditional model, indicating that the inclusion of the predictors in the final model resulted in a better fit to the data (Singer & Willett, 2003). The final model included indicators for local school system, with one indicator randomly excluded, to control for variation at the school system level.

Figure 2. Overlap in the Need for Remedial Coursework at Maryland Community Colleges by Subject Area



Note. Study sample includes Maryland public high school students who earned a regular high school diploma in the 2013-2014 academic year and enrolled in a Maryland community college in the following academic year (2014-2015).

Results

Remedial Coursework in Math

Student-level predictors. Several student-level characteristics were found to be significant predictors of need for remedial coursework in math at Maryland community colleges (see Table 4). After controlling for other demographic characteristics, program participation, academic, and school characteristics, female students (β=0.39, p<.0001) and Hispanic students (β=0.30, p<.0001) were more likely to need remedial coursework in Maryland community colleges. Students were also more likely to need remedial coursework if they were classified as Special Education students (β=0.23, p<.0001), or were eligible for FARMS (β=0.08, p=0.031), after controlling for other characteristics. Students who were less likely to need remedial coursework at Maryland community colleges included students classified as EL (β=-0.98, p<.0001), students with a GPA of 3.0 or greater (β=-0.50, p<.0001), and students who completed two or more courses with a grade of B or higher in math (β=-0.87, p<.0001), foreign language (β=-0.27, p<.0001), or science (β=-0.55, p<.0001), after controlling for other characteristics. Students who were fifth-year graduates were also significantly less likely to need remedial coursework after controlling for other characteristics (β=-0.41, p=0.001).

School-level predictors. Some school-level characteristics were also found to be significant predictors of need for remedial coursework in math at Maryland community colleges. After controlling for individual-level demographic characteristics, program participation, academic, and school characteristics, students who graduated from schools with a higher percentage of students who were eligible for FARMS (β=0.09, p<.0001) were more likely to need remedial coursework in Maryland community colleges. Students who graduated from schools with a higher percentage of students who were fifth-year graduates (β=-0.07, p=0.029) were less likely to need remedial coursework after controlling for other characteristics.

Remedial Coursework in English

Student-level predictors. Several student-level characteristics were found to be significant predictors of need for remedial education in English (see Table 5). After controlling for other demographic characteristics, program participation, academic, and school characteristics, female students (β=0.22, p<.0001) and Hispanic students (β=0.19, p=.001) were more likely to need remedial coursework in English in Maryland community colleges. Students who were eligible for FARMS (β=0.26, p<.0001) and students who were in special education were also more likely to need remedial coursework in English, after controlling for all other factors. White students (β=-0.21, p<.0001) and EL students (β=-0.22, p=.004) were significantly less likely to need remedial coursework, after controlling for all other factors. Students with a GPA of 3.0 or higher (β=-0.46, p<.0001), fifth-year graduates (β=-0.41, p=.001), and students who completed two or more courses with a grade of B or higher in math (β=-0.87, p<.0001),

foreign language (β=-0.27, p<.0001), or science (β=-0.55, p<.0001) were also less likely to need remediation in English after controlling for other characteristics.

School-level predictors. One school-level characteristic was found to be a significant predictor of need for remedial coursework in English. After controlling for individual characteristics and other school-level characteristics, students who graduated from schools with a higher percentage of students who were eligible for FARMS (β=0.10, p<.0001) were more likely to need remedial coursework in Maryland community colleges.

Table 4. Predictors of the Need for Remedial Coursework in Math

						95% CI	
Student-Level Effect	β	SE	t	*p*	*OR*	Lower	Upper
Intercept	1.11	.33	3.34	.001			
Female	.39	.03	11.52	<.0001	1.48	1.38	1.58
White	-.04	.04	-.82	.410	.97	.89	1.05
Hispanic	.29	.05	5.34	<.0001	1.33	1.20	1.48
English Learner (EL)	-.98	.08	-12.81	<.0001	.38	.32	.44
FARMS Eligible	.08	.04	2.16	.031	1.09	1.01	1.17
Special Education	.23	.06	3.97	<.0001	1.26	1.12	1.41
GPA 3.0 or Above	-.50	.05	-10.59	<.0001	.61	.56	.67
Foreign Language Indicator*	-.27	.04	-6.94	<.0001	.76	.71	.83
Math Indicator*	-.87	.04	-20.61	<.0001	.42	.39	.46
Science Indicator*	-.55	.05	-10.81	<.0001	.58	.52	.64
Fifth-Year Graduate	-.41	.13	-3.27	.001	.66	.52	.85
Weeks Attended	.04	.18	.21	.834	1.04	.74	1.46

						95% CI	
School-Level Effect	β	SE	t	*p*	*OR*	Lower	Upper
% FARMS	.09	.02	4.63	<.0001	1.09	1.05	1.13
% English Learner (EL)	-.07	.06	-1.17	.242	.93	.83	1.05
% Fifth-Year Graduate	-.07	.03	-2.18	.029	.93	.87	.99
Weeks Attended	.00	.18	.01	.989	1.00	.71	1.41

Covariance Parameter	Estimate	SE	*Z*	Pr>*Z*
Intercept (School)	.04	.01	4.03	<.0001

Note. FARMS = free and reduced price meals; *Indicates student took two or more classes in the subject with a grade of B or higher; Sample includes Maryland public high school students who earned a regular high school diploma in the 2013-2014 academic year and enrolled in a Maryland community college in the following academic year (2014-2015).

Table 5. Predictors of the Need for Remedial Coursework in English

Student-Level Effect	β	SE	t	*p*	*OR*	95% CI Lower	95% CI Upper
Intercept	-.78	.35	-2.24	.026			
Female	.22	.04	6.01	<.0001	1.25	1.16	1.34
White	-.21	.05	-4.5	<.0001	.81	.74	.89
Hispanic	.19	.06	3.32	.001	1.21	1.08	1.36
English Learner (EL)	-.24	.09	-2.85	.004	.78	.66	.93
FARMS Eligible	.26	.04	6.27	<.0001	1.30	1.20	1.41
Special Education	.79	.06	13.95	<.0001	2.21	1.97	2.46
GPA 3.0 or Above	-.46	.06	-8.28	<.0001	.63	.57	.70
Foreign Language Indicator*	-.46	.04	-10.52	<.0001	.63	.58	.69
Math Indicator*	-.56	.05	-11.18	<.0001	.57	.52	.63
Science Indicator*	-.48	.06	-7.54	<.0001	.62	.55	.70
Fifth-Year Graduate	-.15	.13	-1.15	.250	.86	.66	1.11
Weeks Attended	.32	.24	1.32	.188	1.37	.86	2.19

School-Level Effect	β	SE	t	*p*	*OR*	95% CI Lower	95% CI Upper
% FARMS	.10	.02	5.06	<.0001	1.11	1.07	1.15
% English Learner (EL)	-.10	.07	-1.60	.109	.90	.79	1.02
% Fifth-Year Graduate	-.02	.03	-0.46	.644	.98	.92	1.05
Weeks Attended	-.26	.24	-1.09	.276	.77	.48	1.23

Covariance Parameter	Estimate	SE	*Z*	Pr>*Z*
Intercept(School)	.06	.01	4.38	<.0001

Note. FARMS = free and reduced price meals; *Indicates student took two or more classes in the subject with a grade of B or higher; Sample includes Maryland public high school students who earned a regular high school diploma in the 2013-2014 academic year and enrolled in a Maryland community college in the following academic year (2014-2015).

Summary of Results

Overall, 57% of students entering Maryland community colleges in 2014-2015 were assessed to need remediation, and most of those students (92%) needed remediation in math. The multilevel modeling (MLM; Raudenbush & Bryk, 2002) approach indicated that both individual-level and high school-level characteristics were significantly related to the need for remedial education in Maryland community colleges. The results were largely similar for both math and English remediation. The student characteristics that were related to increased likelihood of needing remediation in math and English included gender (female), Hispanic, eligibility for FARMS, and Special Education status. EL students, students with a GPA of 3.0 or

higher, fifth year graduates, and students who completed at least 2 courses in math, science, or foreign language with a B or higher were less likely to need remedial coursework in math and English in Maryland community colleges. One significant student-level result differed between math and English outcomes: after controlling for all other factors, white students were less likely than students of other races to need remedial coursework in English at Maryland community colleges. In terms of high school-level predictors, attending a high school with a higher percentage of students who were eligible for FARMS increased the likelihood of being assessed to need remediation in math and English in Maryland community colleges. For math only, attending a high school with a higher percentage of students who were fifth year graduates was related to a lower likelihood of needing remedial coursework in Maryland community colleges.

Discussion

The goal of this study was to expand upon prior research by examining the student-level and high school-level predictors of needing remedial coursework upon entrance to a Maryland community college. A large percentage of Maryland public high school graduates who enter community colleges were assessed to need remediation in math, English, or reading. Better understanding the early predictors of needing remedial coursework is critical for developing and identifying prevention and intervention programs to prevent the need for remedial coursework at Maryland community colleges.

The findings of this study were consistent with previous literature reporting the relation between individual student characteristics and need for remedial coursework (e.g., Henneberger et al., 2016; Hodara, 2015; Howell, 2011). Consistent with prior research, this study found that after controlling for other factors, students who were female, Hispanic, eligible for FARMS, and in Special Education were more likely to be assessed to need remedial coursework at Maryland community colleges.

The finding that EL students were less likely to be assessed to need remedial coursework at Maryland community colleges is somewhat consistent with prior research, although research is mixed. Flores and Drake (2014) examined data from Texas and found that for students who entered a two- or four-year college in the fall of 2007, EL students were more likely than non-EL students to take remedial courses in English or writing, but less likely to take remediation in math. Additionally, a study using data from Oregon students who graduated from public high schools between the 2004-2005 academic year and 2010-2011 academic year and enrolled in a community college at any point from the 2005-2006 academic year through the 2011-2012 academic year found that EL students were more likely to need remediation (Hodara, 2015). It is possible that the additional supports provided to EL students in Maryland public school systems helps to reduce their likelihood for needing remedial coursework in community colleges. EL services focus primarily on language acquisition, but the concept of the “Bilingual Brain” suggests significant cognitive benefits of bilingualism, and bilingual individuals tend to outperform monolingual individuals in executive functioning and information selection tasks (Stocco et al., 2014). This “Bilingual Brain” hypothesis is supported by the finding from the

current study that students who received a grade of "B" or higher in two or more foreign language courses in high school were less likely to need remediation in math. Another possible explanation could be that the additional adult attention provided to ELL students around language support has corollary benefits in adjacent subjects, such as math. Future research should further examine the specific supports provided to EL students in high school and how they may relate to positive college outcomes.

Additionally, the current study examined high school-level characteristics to determine the relevant options for prevention and intervention at the high-school level. Consistent with prior research (e.g., Hodara, 2015; Howell, 2011), high school level characteristics, including the percentage of students eligible for FARMS and the percent of students who were fifth-year graduates, were related to a student's assessed need for remedial coursework in Maryland community colleges. Students in schools with higher percentages of students eligible for FARMS were more likely to need remedial coursework in English and math. It may be that these schools are under-resourced, and thus, less able to provide college readiness supports for students. Future research should focus on the development and implementation of prevention and intervention programs for students in schools with high percentages of students living in poverty. Additionally, students in high schools with higher percentages of students graduating in the fifth year were less likely to need remedial education in math. The additional support and interventions provided in these schools may help to prevent the need for remedial education in college. Future research should further examine the specific supports provided and determine how those supports could be expanded and improved.

Students who attended a fifth year of high school were less likely to need remedial coursework upon entering Maryland community colleges. From a social justice perspective, this finding is important to consider within the context of the cycle of poverty. It is well-established in the research literature (and confirmed in the current study) that low income students are more likely to be assessed to need remedial coursework (Attewell et al., 2006; Clotfelter et al., 2015; Henneberger et al., 2016). It is also well-documented that students who take remedial coursework in college are less likely to graduate from college, and, those who do graduate, take longer and likely spend more money on the same college education (Clotfelter et al., 2015; Henneberger et al., 2016). Graduating the student from high school shifts the burden of payment for public education from the State to the individual student. Since this shift occurs disproportionately for remedial coursework for students living in poverty, the cycle of poverty is likely perpetuated where students in poverty are less likely to obtain a college degree and do so at significant costs, further placing them into poverty. In contrast a fifth year of high school shifts the burden of payment back to the public school system, while demonstrating a reduction in the need for remedial coursework upon entering Maryland community colleges.

This study was strengthened by the use of multilevel modeling (MLM; Raudenbush & Bryk, 2002) with statewide linked administrative data. However, the results of this study should be interpreted within the context of the following limitations. First, using the MLM approach enabled us to examine the relation between student- and high school-level predictors and the need for remedial coursework while controlling for a number of confounding variables, but a number of potentially important variables about the student and the high school are not

included in the MLDS data. Unmeasured variables that may be related to the need for remedial coursework in college include additional information about the student, such as behavioral characteristics, study skills, and parent education levels (Orange & Hodges, 2015), as well as additional information about the high school, such as school climate, teacher education and experience (Howell, 2011), and professional development for teachers on college readiness (Cline et al., 2007). Second, the measurement of needing remedial coursework is limited to a yes/no indicator. A continuous score on a student's remedial placement exam would offer a more nuanced ability to examine the relation between student and high school-level predictors and the need for remedial coursework in college.

Policy Implications

The identification of early risk factors associated with the need for remedial coursework is critical for enabling high school and community college administrations to develop and implement prevention and intervention programs that support selected subgroups of students. The results of this study suggest that tailoring prevention and intervention programs toward females and Hispanic students as well as students who qualify for free and reduced meals and Special Education may help to prevent the need for remedial coursework in community colleges. Characteristics of the high school are also important for developing focused prevention and intervention programs, and the results of this study suggest that tailoring prevention and intervention programs toward schools with a higher percentage of students living in poverty may help to prevent the need for remedial coursework in community colleges.

Also important to consider for policy, is the finding that students who were fifth year high school graduates were less likely to need remedial coursework upon entering Maryland community colleges. Establishing what is happening in the fifth year of high school for these students and wrapping those supports into the typical four year experience of high school or into a summer program following high school may help to reduce some of the need for remedial coursework. From a social justice perspective, this is important for shifting the burden of paying for remediation in community college away from the individual student and back to the State through the provision of additional services in high school.

Future Research

Future research on remedial coursework in Maryland may benefit from examining the relation between students' high school course-taking patterns and need for remedial coursework, which may enable school administrators to suggest course trajectories that may help to prevent the need for remedial coursework in college. It would also be informative to investigate the long-term college outcomes for students who take remedial courses compared to students who are assessed to need remedial courses but do not enroll or students who are not assessed to need remediation. Long-term outcomes could include persistence to the second year of college, degree attainment, and workforce wages. Furthermore, examination of whether need for remedial coursework in more than one subject is differentially associated

with negative outcomes in comparison to need for remedial coursework in only one subject may help to further guide policy and practice.

Conclusion

This report used multilevel modeling (MLM) to examine the student and high school-level predictors of needing remedial coursework in Maryland community colleges. The rate of needing remedial coursework in Maryland community colleges was high (57%), with the greatest need in math (92%). Consistent with prior research, this study reported that student-level characteristics (e.g., gender, Hispanic, EL, eligibility for FARMS, Special Education status, and academic indicators) and high school-level characteristics (e.g., percent of students eligible for FARMS; % of students who were fifth year graduates) were associated with need for remedial coursework in Maryland community colleges. The results of this study can be used to tailor prevention and intervention programs to help specific students and high schools in order to prevent the need for remedial coursework in community college.

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