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High School Completion in Context: Student- and School-level Factors Related to On-Time Graduation

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COVER PAGE

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Short biographical statement: *Mathew C. Uretsky* is an Assistant Professor in the School of Social Work at Portland State University. His research examines the risk and protective factors that affect the academic and behavioral development of children and youth, with a focus on family and school dynamics.

Title: High School Completion in Context: Student- and School-level Factors Related to On-Time Graduation

One- or two-sentence description of the article (for the contents page): The current study addresses the substantive gaps in research regarding high school non-completion by examining the college and workforce outcomes of *persisters*—defined here as students who do not formally withdraw from high school, nor earn a regular diploma, four years after entering high school as a first-time ninth grader.

STRUCTURED ABSTRACT

Background/Context: There is an expansive body of research concerning high school graduation; however, most studies omit students who persist through four years of high school without earning a diploma. In addition, there is scant research exploring longer-term outcomes among students whose academic trajectories do not fit within the traditional four-year model of high school graduation, including eventual graduation, post-secondary enrollment, or engagement in the workforce.

Purpose/Objective/Research Question/Focus of Study: The current study addresses the substantive gaps in research regarding high school non-completion by examining the college and workforce outcomes of *persisters*—defined here as students who do not formally withdraw from high school, nor earn a regular diploma, four years after entering high school as a first-time ninth grader.

Research Design: The present study accessed five years of linked, longitudinal, student-level administrative data from the Maryland Longitudinal Data System. Multilevel models assessed the relationship between student- and school-level factors with the odds of students earning a high school diploma four years after beginning their first-freshmen year. Independent variables included student-level demographic and academic indicators and school-level concentrations of student characteristics.

Conclusions/Recommendations (required): This study offers a first look into the academic and employment trajectories of an understudied and high-risk group of young adults. The multilevel examination of student- and school-level factors indicated that on-time graduation for 4-year persisters should be understood as a function of students within their academic

environment. Overall, persisters had less favorable college and workforce outcomes when compared to students who earned a high school diploma, suggesting the need for interventions that promote college and workforce readiness across the population of persisters. The findings presented herein suggest that the phenomenon of persisting should be considered, along with dropout, as a critical element of a more informed analysis of high school graduation. Implications for research, policy, and practice are discussed.

Executive Summary

Over the past decade, there has been a national trend towards lower dropout and increasing graduation rates. As more students are staying in school longer, we must also examine the academic pathways of the often-overlooked population of students who persist into and through four, or even five years, of high school without earning a diploma. This group of students—defined here as persisters—has been excluded by omission from the national conversation on dropout and high school graduation. There has been no common terminology to describe such students, no requirement to collect data describing their prevalence or later outcomes, and no programming attuned to their specific needs. Unfortunately, studies examining dropout or on-time graduation often exclude these students for having “missing” outcome data, or mislabel them as dropouts.

There is an expansive body of research concerning high school graduation; however, most studies omit students who persist through four years of high school without earning a diploma. In addition, there is scant research exploring longer-term outcomes among students whose academic trajectories do not fit within the traditional four-year model of high school graduation, including eventual graduation, post-secondary enrollment, or engagement in the workforce. The current study examines this substantive gap in research knowledge by following a cohort of first time freshmen through four years of high school to examine their secondary, post-secondary, and workforce outcomes.

Method. The present study accessed five years of linked longitudinal student-level secondary, post-secondary, and workforce data from the Maryland Longitudinal Data System. The study sample included 4,190 high school students who were enrolled as first-time freshmen in one of 40 Baltimore city Public high school during the 2010-2011 school year. Multilevel

models assessed the relationship between student- and school-level factors with the odds of students earning a high school diploma four years after beginning their first-freshmen year of high school. Independent variables included student-level demographic and academic indicators and school-level concentrations of student characteristics. In addition, the preliminary 5th year secondary, post-secondary and workforce outcomes of students were compared using descriptive statistics.

Results. Twenty-two percent of students who persisted through four years of high school did not graduate on time. The z -test for the covariance parameters indicated the presence of statistically significant between-school variation in school exit type, providing justification for the use of multilevel modeling techniques. Several student-level factors were related to the odds of on-time graduation, such as below average attendance or not passing an High School Assessment by the end of the first freshmen year. Factors related to student academic history had a stronger relationship to the odds of on-time graduation than demographic indicators. Notably, race and special education status were not significantly related to the odds of on time graduation. The school environment played an important role in student outcomes, accounting for 25% of the variation in on-time graduation; however, the addition of school-level contextual variables did not explain any additional variation in the model after controlling for student-level factors. The majority of persisters reenrolled for a fifth year of high school, however less than a quarter had earned a GED or diploma by the years end. Around half of persisters worked during their fifth year, a rate much lower than that found among the on-time graduates.

Conclusions and recommendations. This study offers a first look into the academic and employment trajectories of an understudied and high-risk group of young adults. The multilevel examination of student- and school-level factors indicated that on-time graduation for 4-year

persisters should be understood as a function of students within their academic environment. Although significant between-school variation was identified there remains a need for additional examination of the school-level factors that may provide opportunities for system-level intervention. In addition, there is a demonstrated need to more closely evaluate the relationship between mobility and on-time graduation. Overall, persisters had less favorable college and workforce outcomes when compared to students who earned a high school diploma, suggesting the need for interventions that promote college and workforce readiness to prepare these students for the transition into adulthood. Among persisters there was a high rate of reenrollment and attendance in the fifth year of high school. This suggest that this group of students remain, at minimum, behaviorally engaged in school even after their expected graduation date has come and gone. A renewed focus on promoting high school graduation that is inclusive of persisters should include efforts to cultivate a school environment and programming that leverages the continued engagement exemplified by persisters, and develop programming that strives to close the gap between persisting and graduating.

Over the past decade, there has been a national trend towards lower dropout and increasing graduation rates, culminating in a record high four-year graduation rate of 81% in 2013 and an event dropout rate of 3% (Kena et al., 2015; Stark & Noel, 2015). As we celebrate this trend of less students dropping out, and more students staying in school longer, we must also examine the academic pathways of the often overlooked population of students who persist into and through four, or even five years, of high school without earning a diploma (Kena, Aud et al., 2014). This group of students—defined here as persisters—has been excluded by omission from the national conversation on dropout and high school graduation. There has been no common terminology to describe such students, no requirement to collect data describing their prevalence or later outcomes, and no programming attuned to their specific needs. Although detailed data regarding this phenomenon is not collected at the national level, a comparison of available national graduation and dropout rates (81% and 3% respectively; Kena et al., 2015; Stark & Noel, 2015) suggest that persisters may constitute up to 16% of each graduating cohort. A recent study conducted in New York City identified 19% of the 2016 graduating class as “persisting students” providing some preliminary corroboration of the preceding estimate (Hill & Mirakhur, 2018). Unfortunately, educational researchers often censor these students out of their analyses for having “missing” outcome data, or mislabel them as dropouts. In the current study, I will examine this substantive gap in research knowledge by following a cohort of first time freshmen through four years of high school to examine their secondary, post-secondary, and workforce outcomes.

The consequences of non-graduation

Students who leave school without earning a diploma, including dropouts and non-completing persisters, face increased odds of multiple adverse outcomes, including: lower

lifetime earnings (Rouse, 2007), higher rates of unemployment (U.S. Department of Labor, 2014), poor health outcomes (Blackwell, Lucas, Clarke, 2014), incarceration (Aud et al., 2011), and increased reliance on welfare programs (Maynard, Salas-Wright, & Vaughn, 2015). Taking into account the increased use of public assistance, higher rates of criminal activity and incarceration, Medicaid costs, and reduced tax revenue, Belfield, Levin, and Rosen (2012) calculated that each youth who did not graduate from high school in 2011 cost society an estimated \$755,900 over the student's lifetime. In the same report, Belfield and colleagues estimated a total cost to society of 1.96 trillion dollars for 3.3 million youth between the ages of 16 and 24 who had not earned a diploma in 2011.

As young people transition out of adolescence and move toward adulthood, their educational attainment is strongly associated with important life outcomes such as physical health, mental well-being, and participation in the workforce (Rumberger, 2011; Vaughn, Salas-Wright, & Maynard, 2014). Further, a recent study using national data found that emerging adults between the ages of 18 and 24 who reported dropping out of school had increased odds of reporting recent arrests for larceny or assault (Maynard et al., 2015). Although dropouts reported a lower risk of binge drinking and no significant additional risk for drug dependency, they were more likely than high school graduates to be arrested for drug offenses. Dropouts were also more likely than high school graduates to be unemployed, have a household income below \$20,000, enroll in government assistance programs, and have a recent suicide attempt (Maynard et al., 2015).

Persisters

There is a broad literature concerning high school graduation and dropout; however, most previous research has focused on student dropout regardless of years of high school completed,

or excluded students who persist through four years of high school without earning a diploma (De Witte, Cabus, Thyssen, Groot & van den Brink, 2013; Rumberger & Lim, 2008). As such, it is unclear whether the extant research knowledge is relevant to the related but potentially distinct population of persisters (Hill & Mirakhor, 2018). Furthermore, it is unclear whether the strategies applied in previous efforts to reduce dropout and promote on-time graduation would be effective in promoting persisters in their efforts to earn a high school diploma (Goldschmidt & Wang, 1999; Lakkaraju et al., 2015).

There is no national count reflecting the true prevalence of persisters, nor is there any peer-reviewed literature describing their characteristics. For the most part, any such knowledge must be extrapolated from existing publicly reported data. For example, among the Baltimore City students who began their first ninth grade year in the fall of 2010, 11% dropped out and 70% graduated in four years—after accounting for students who transferred-in, transferred-out, or passed away. This left an additional 19% of students who completed four years of high school, but did not earn a diploma (MSDE, 2015a). A similar pattern can be observed at the national level. In 2012, an estimated 16% of first-time ninth graders attending a U.S. public school persisted through four years of high school, but did not graduate on time (Stetser & Stillwell, 2014). In this changing landscape, the data suggest that percentage of students persisting into and through four years of high school without earning a diploma may rival or exceed the cumulative percentage of students lost to dropout.

Factors Related to School Leaving

Building upon Bronfenbrenner (1979; 2005)'s ecological model of human development, Rumberger (2011) proposed the Conceptual Model of High School Performance, which encouraged researchers to consider how the family, school, and community contexts influence

individual student outcomes. In contrast to earlier work on non-graduation that focused primarily on student-level characteristics, the model framed the predictors of high school graduation as both multilevel and interdependent. Rumberger (2011)'s conceptual model depicts the relationship between four individual and three institutional factors with student performance. Individual factors included measures of student educational performance, behaviors, attitudes, and background. Institutional factors included measures of the composition, structure, resources, and practices across three institutional contexts—family, school, and community (Rumberger, 2011; Rumberger & Lim, 2008).

There is a broad literature available that describes the causes and consequences of student dropout and to a lesser extent non-graduation (see De Witte et al., 2013; Rumberger & Lim, 2008; Zaff et al., 2016). In contrast, there is a paucity of peer-reviewed literature examining the utility of these factors in understanding the drivers of on-time graduation or persisting. Although there is a dearth of empirical analyses on the subject, there is some evidence that persisters share a similar academic and demographic profile with dropouts (Hill & Mirakhur, 2018).

Research Aims and Hypotheses

The current study explored the causes and consequences of persisting (vs. on-time graduation) among a cohort of first-time freshmen in the Baltimore City Public School System. In addition, I describe some of the proximal student outcomes (i.e. fifth-year graduation, workforce participation, post-secondary enrollment). The analyses focused on malleable factors drawn from data regularly collected by the school district. Specifically, we address the following research questions:

Research Question 1. Do between-school differences account for any of the variance in students odds of on-time graduation and persisting?

Research Question 2. How do student- and school-level factors, measured in the first-freshman year, contribute to the odds of on-time graduation for students who persist into and through their fourth year of high school?

Research Question 3. What are the preliminary secondary, postsecondary and workforce outcomes of students by exit type?

Method

All student- and school-level data were drawn from the Maryland Longitudinal Data System (MLDS). The Maryland Longitudinal Data System Center (MLDSC) is an independent unit of State government responsible for building and maintaining a statewide longitudinal data system that includes linked K-12, post-secondary, and workforce data (Maryland Longitudinal Data System Center, n.d.). The MLDS includes de-identified individual level data for all students attending public schools in Maryland beginning with the 2007-2008 school year. Data were collected in real-time by school site staff and reported annually by school districts to MSDE.

Data Protections and IRB

The Maryland Longitudinal Data System Center requires a federal background check and security training prior to accessing data. To protect confidentiality, all findings were aggregated to the school level. In order to ensure compliance with the MLDSC reporting standards, all percentages were rounded to the nearest whole number and any categories that included fewer than 10 students were excluded from the analyses and reported findings (NCES, 2010). In addition to the previously stated security precautions, a research protocol was submitted to the University of Maryland and deemed exempt.

Sample Selection

Students were assessed for inclusion in the study sample if they had attended a BCPSS High School in the 2013-2014 school year and were enrolled as first-time freshmen in a BCPSS high school for a period of 90 days or more during the 2010-2011 school year. Per the focus of the current study on persisting and on-time graduation, students who formally withdrew from school and did not re-enroll during the 2013-2014 school year were excluded from the sample. In addition, because the current study focused on a single school district, students who transferred out of the district or to a non-public school during the 2013-2014 school year were excluded from the sample (>1%). Students who attended schools that exclusively enrolled special education students or were designated as seeking a certificate of completion were excluded from the sample as the services provided and populations served were, by design, distinct from the general population (>1%). Students in the study sample were enrolled in 40 BCPSS high schools. The school-level characteristics were determined by examining the characteristics of all students enrolled as ninth-graders in each of the 40 included schools for a period of 90 days or more during the 2010-2011 school year.

Measures

The variables included in the current study were selected based on their relationships to dropout and on-time graduation as documented in the existing literature. Study variables fell into three categories: the dependent (outcome) variable, student-level variables, and school-level variables. Crosstabs were run for categorical independent variables by school to ensure compliance with the MLDSC reporting standards.

Dependent Variable

School exit type. School exit type was coded as a dichotomous variable indicating that a student either persisted through four years of high school without earning a regular diploma (0 =

Persister) or completed the requirements for a Maryland High School Diploma by the end of SY 2013-2014 (1 = On-time graduate).

Student Characteristics. Variables describing individual student characteristics fell into three broad categories. (1) Demographic characteristics: Race, Gender, eligibility for the free and reduced meals program (FARMs), and Age. (2) Student academic characteristics; Promoted, Passed a High School Assessment (HSA), and Participation in Special education, and (3) Student behaviors: Mobility and Attendance.

The majority of the individual students characteristics were coded as dichotomous variables: eligible for FARMs (vs. not), Promoted to 10th grade on time (vs. not), enrolled in special education services (vs. not). The student population in BCPSS was nearly 80% Black, therefore race was coded as Black (vs. Other Race). Mobility was coded as a dichotomous variable indicating whether students attended more than one school during their first-freshmen year vs. not. Gender was coded as a binary variable female vs. male as the data did not include a code for transgender or gender non-conforming. Pass HSA (high school assessment) was coded as a dichotomous variable indicating whether a student passed at least one HSA by the end of their first-freshmen year (vs. not). Starting with the 2005 freshman cohort, students attending a Maryland public high school were required by the state to take and pass four HSAs (Algebra/Data Analysis [Math], English, Biology, and Government) as a prerequisite for earning a diploma (for information about alternative methods for meeting the HSA requirement see Maryland High School Assessments, 2014). Age was coded as a continuous variable indicating a student's age in years on August 30, 2010. Attendance was calculated as the number of five-day school week equivalents that students were in attendance during the August-to-June reporting period of the 2010-2011 school year, ranging from 18 to 36.

School Characteristics

The variables used to operationalize school characteristics were based on the student-level characteristics for all ninth graders attending a BCPSS high school in the 2010-2011 school year. The one exception was school size, which was calculated using the total student enrollment for grades 9-12 in the 2010-2011 School Year. Level-2 measures of school characteristics were calculated based on the last school a student attended in their first-freshmen year. This was done, in order to emulate the information that district staff would have available to assess a student's odds of on-time graduation at that point in time. All school-level characteristics were rescaled by dividing the parameters by 10, in order to produce ranges more similar in scale to the student-level parameters and improve the interpretability of the results (Kline, 2011).

Data Analysis

All data analysis for the current study was performed using SAS software, Version 9.3. The study design and inclusion criteria precluded any missing data for the outcome variable. Similarly, there were no missing data among the variables describing student and school characteristics. All assumptions of the multilevel logistic regression were assessed (Cohen Cohen, West, & Aiken, 2003). Studenmund (2014) suggests that including factors with bivariate correlations above .80 may introduce multicollinearity into multilevel models. As such, the assumption of non-multicollinearity was assessed for student and school characteristics by running Pearson's product-moment correlations between normally distributed continuous independent variables (Cohen et al., 2003).

Data Analysis by Research Question

Three methods were employed to address the research questions proposed herein. First, bivariate relationships between independent variables and the dependent variable were tested using chi-square analyses and independent samples *t*-tests as appropriate (Cohen et al., 2003). Next, a series of multilevel models with a logit link were used to assess the degree to which school-level predictors explain any variation in school exit type after the inclusion of student-level predictors. A multilevel modeling (MLM) approach is the suggested method for analyzing nested data (Raudenbush & Bryk, 2002). This is important because the experiences of students within a school are theorized to be influenced by features that are specific to that school. Finally, the preliminary 5th year secondary, post-secondary and workforce outcomes of students were compared using descriptive statistics.

A random intercept model was used to examine the differences in the outcome variables across schools. All additional model parameters were treated as fixed effects. Students graduation outcomes were nested in the school they attended for their last enrollment in year 4. To answer research question 1, a multilevel logit model with no predictors (unconditional model) was run to determine whether there was sufficient variability in the dependent variable across schools to justify a MLM (Hox, 2002). A level-2 variance intercept that is significantly different from zero indicates that a portion of the variance in the dependent variable is due to differences between schools, providing justification for the MLM approach (Raudenbush & Bryk, 2002). Maas and Hox (2005) found that multilevel models with level-2 sample sizes as low as 30 were sufficient to produce unbiased estimates of the regression coefficients, variance components, and standard errors of regression coefficients ($\alpha=.05$). However, for models with level-2 sample sizes of 30 and 50, the standard errors of level-2 variance intercept were underestimated, producing non-coverage rates of 8.9% ($\alpha=.011$) and 7.4% ($\alpha=.026$) respectively. Given the level-2 sample

size of 40 for research question 1, the threshold for rejecting the null hypothesis for level-2 variances was adjusted to compensate for the possibility that the standard errors of level-2 variance intercept were underestimated ($\alpha=.011$).

To answer research question 2, a series of multilevel logit models were run to assess the impact of student- and school-level predictors on the odds of school exit type using on-time graduation as the reference group. Predictors were entered into the models in blocks beginning with student-level factors followed by school-level characteristics. Successive models were tested for improvements in model fit using the log-likelihood ratio test. If the observed difference in log-likelihood was significant, the model with more parameters provided a better fit to the data and vice versa (Raudenbush & Bryk, 2002).

Results

Comparisons of the categorical student-level characteristics by exit type are presented in Table 1. The bivariate relationships between the categorical indicators and school exit type were assessed using the chi-square test of independence. There were significant relationships ($\alpha = .05$) between school exit type and all of the categorical independent variables.

-----insert Table 1. about here-----

There was a significant relationship between gender and school exit type. Eighty-four percent of females who persisted through their fourth year of school graduated on time compared to 71% of males. The on-time graduation rate for students who identified as Black was 7 points lower than for students in the Other Race category. Students who received special education services had an on-time graduation rate that was 15 points lower than students in mainstream education programs. The on-time graduation rate among students eligible for the FARMs

program was 11 points lower than students not eligible for FARMs. Students who experienced mobility in their first-freshman year had an on-time graduation rate 16 points lower than the rate for students who attended just one school during the 2010-2011 school year. The on-time graduation rate for students who passed at least one HSA in their first-freshman year was 23 points higher than students who had not. The on-time graduation rate for students who were promoted at the end of their first-freshman year was 42 points higher than students who were did not earn sufficient credits to advance to the 10th grade.

Comparisons of the continuous student-level characteristics by exit type are presented in Table 2. The bivariate relationships between the continuous indicators and school exit type were assessed using the independent samples *t*-test. The results indicate that there were significant differences in mean values for the continuous student characteristics by school exit type ($\alpha = .05$). On average, on-time graduates were about 4 months (0.34 years) younger than persisters when they entered their first-freshman year. In addition, on-time graduates attended about five more weeks of school in their first-freshman year than persisters. This means that the average on-time graduate attended about 94% of days in their first-freshmen year; compared to 80% for persisters. The latter rate of 20% absences meets the MSDE threshold for habitual or chronic truancy (MSDE, 2015b).

-----insert Table 2. about here-----

Multivariate Analyses

Research Question 1. Do student odds of on-time graduation and persisting vary across schools? The results for the unconditional multilevel logit model (RQ1) run to address research question 1 are presented in Table 3. The *z*-test for the covariance parameters ($z=4.05, p$

<.0001) indicated a statistically significant between-school variation in school exit type, providing justification for the use of multilevel modeling techniques (Raudenbush & Bryk, 2002). The covariance parameter intercept in Table 3 was used to calculate an intraclass correlation of .25, indicating that a quarter of the total variation in the probability of on-time graduation or persisting can be attributed to differences between schools. This presence of statistically significant between-school variation in school exit type indicates that MLM is the appropriate method for addressing research question two.

-----insert Table 3. about here-----

Figure 1 presents an illustration of the unconditional random intercepts for each high school ranked by the log-odds of on-time graduation. This provides an estimate of the school-specific variation in the probability of on-time graduation due to between-school differences before controlling for student or school-level factors. In the figure, the “d” represents the log-odds of on-time graduation or persisting for an average student in each school respectively. The bar represents the standard error of the estimate. If the standard error bar crosses zero, then the effect was not statistically significant ($p > .05$), indicating that the odds of on-time graduation for students attending that school were not significantly different from the district average. If the standard error bar did not cross zero, the odds of on-time graduation for students attending that school were significantly different from the district average ($p < .05$). If the effect was positive, the likelihood of on-time graduation was greater than the district average for students attending that school. If the effect was negative, the likelihood of on-time graduation for students attending that school was below the district average. The likelihood that an average student would graduate on time was significantly above the district mean at seven schools and significantly below the district mean at six schools.

-----insert Figure 1. about here-----

The purpose of research question 2 was to examine the relationships between student- and school-level characteristics and the odds of persisting versus on-time graduation. To address this question, a series of multilevel logit models were run that included a set of within- and between-school predictors as fixed effects: (1) in Model RQ2a student-level factors were entered as level-1 predictors and (2) in Model RQ2b school characteristics were entered as level-2 predictors along with the student-level predictors from model RQ2a.

A log-likelihood difference test was conducted to identify whether the inclusion of additional parameters in each successive model resulted in a significant improvement in model fit (Ene et al., 2015). The results (see note in Table 3), indicate that the inclusion of the student-level predictors in Model RQ2a resulted in a significant improvement in model fit over the null model ($\chi^2_{(9)} = 597.230, p < .0001$). The inclusion of school-level characteristics in Model RQ2b did not result in a significant improvement in model fit compared to Model RQ2a ($\chi^2_{(6)} = 7.020, p = .319$), indicating that school characteristics did not explain any additional variance in school exit type after controlling for student-level factors. Therefore, Model RQ2a is interpreted (see Table 3 above).

Older students and students who were eligible for the FARMs program were less likely to graduate on time. Being female, having higher levels of attendance, between-school mobility, being promoted, and passing at least one High School Assessment by the end of the ninth grade were related to increased odds of on-time graduation. For students entering their first-freshman year, being one year older than the mean age represented a 17% decrease in their odds of on-time graduation. Female students had 97% higher odds of on-time graduation than males. Students eligible for FARMs had 26% decreased odds of on-time graduation compared to students who

were not eligible for FARMs. Each additional week of school that a student attended during their first-freshman year, represented a 17% increase in their odds of on-time graduation.

Students who changed schools during their first-freshman year had 38% increased odds of on-time graduation. Students who were promoted to the 10th grade at the end of their first-freshman year had 115% higher odds of graduating on time compared to students who were retained at the end of the 2010-2011 school year. The odds of on-time graduation were 220% higher for students who had passed at least one HSA by the end of their first-freshman year compared with those who had not passed at least one HSA. Being Black and being identified as requiring Special Education services were not significantly related to the odds of on-time graduation after controlling for the other factors in the model.

An illustration of the odds ratios (OR) and corresponding 95% confidence intervals (CI) for the student-level factors included in Model RQ2a are presented in Figure 2. For each parameter, the dot identifies the OR and the horizontal line represents the CI. If the CI crosses one, then the predictor was not significantly related to the odds of on-time graduation ($p > .05$). If the CI does not cross one, the value of the model parameter ($p < .05$) was significantly related to the odds of on-time graduation. If the OR was greater than one, then that parameter was significantly related to increased odds of on-time graduation. If the OR was less than one, the parameter was significantly related to decreased odds of on-time graduation.

-----insert Figure 2. about here-----

Fifth-year Academic and Workforce Experiences

First, a series of variables were created to describe fifth-year high school enrollment and achievements of the four-year persisters (Table 4). Two-thirds (66%) of persisters enrolled in,

and attended, at least one day at a Baltimore City high school in year 5. One-fifth (19%) of the four-year persisters earned a regular high school diploma from a Baltimore City high school by the end of the fifth year and <5% of the four-year persisters earned a GED, leaving approximately three-quarters (~76%) who enrolled in year 5 without earning a diploma or GED that year.

-----insert Table 4. about here-----

Finally, a variable was created to assess whether students from the study sample participated in the workforce during the 2014-2015 school year (see Table 4). The variable was created using linked wage data provided to the MLDSC by the Maryland Department of Labor, Licensing and Regulation. These data include the wages for persons employed in Maryland who also attended a public Maryland secondary or postsecondary institution. The data do not include wages related to Military Service, Federal Government employment, or independent contractors. More than two-thirds (71%) of the students in the study sample were identified as having worked in Maryland in the fifth year; the rate of workforce participation was 20 points lower for persisters (56%) compared to on-time graduates (76%).

Discussion

The current study found that a quarter of the variation in on-time graduation versus persisting was due to differences between schools. This means the likelihood that students in this sample would graduate on time differed by as much as 25% depending on the school they attended. This finding is supported by prior studies that have reported that 17% to 23% of the total variance in dropout was due to between-school differences (Goldschmidt & Wang, 1999; Li, 2007; Rumberger & Palardy, 2004). Taken together, these findings support the assertion that

school-level factors should be considered when developing efforts to promote on-time graduation (Rumberger & Lim, 2008).

Student-Level Factors and School Exit Type

Several key findings were consistent with prior research examining the relationship between student-level characteristics and dropout or on-time graduation. This includes the previously identified relationships between higher levels of ninth grade attendance (Carl, Richardson, Cheng, Kim & Meyer, 2013; Mac Iver & Messel, 2012), promotion (Allensworth & Easton, 2007; Norbury et al., 2012), and performance on standardized tests (Reardon, Arshan, Atteberry, & Kurlaender, 2010; Rumberger & Lim, 2008) with reduced odds of non-graduation. In addition, students who were older when they entered their first-freshman year were less likely to graduate on time. This finding is consistent with prior studies that have used age as a proxy for retention in earlier grades (Rumberger & Lim, 2008; Saunders, Silver, Zarate & Team, 2008).

Race was not significantly related to the odds of on-time graduation or persisting after controlling for other student-level factors. De Witte and colleagues (2013) argued that many of the observed differences in academic outcomes associated with individual characteristics such as race are likely artifacts of social inequity and economic imbalances. The finding that students who were eligible for the free and reduced priced meals program during their first-freshman year were less likely to graduate on time would seem to support this line of argument. Similarly, and consistent with prior research on the subject, special education status was not related to the odds of on-time graduation in this sample after controlling for other student-level factors (Zablocki & Krezmien, 2013).

Among the student-level factors examined in the current study, two factors produced findings that were discrepant with the prior literature. First, between-school mobility in the first-freshmen year was significantly related to increased odds of on-time graduation versus persisting. This conflicts with prior research that has identified a robust relationship between mobility and higher rates of dropout and non-graduation (Metzger et al., 2015; Rumberger & Lim, 2008). This may be related to how mobility was operationalized. In the current study, a student was considered to have experienced mobility if they changed schools during their first-freshman year, whereas previous studies have considered longer periods of time or used residential changes to operationalize mobility (Metzger et al., 2015; Rumberger & Lim, 2008; Saunders et al., 2008).

Students change schools for a multitude of reasons that were not captured in the study data, including residential mobility, student and/or parental concerns about school performance or safety, or student behavior. In addition, changes due to residential mobility may signal the presence of other intervening factors, or omitted variables, such as changes in family structure or finances, as well as concerns about neighborhood-level factors, such as crime. The positive relationship between mobility and on-time graduation suggest the possibility, that for some students in this sample, mobility may be—at least partially—a function of students and their caregivers seeking a more favorable academic environment. If an omitted variable, (e.g. parental involvement) is positively correlated with both mobility and on-time graduation, the odds ratio for mobility may be positively biased to the point that it changes the sign of the parameter estimate. This would also serve as a potential explanation for the incongruity between the odds ratio for mobility results and the descriptive statistics from the present study, which reported that

the on-time graduation rate for mobile students was 16 points lower than non-mobile students (see Table 1 above).

Second, the finding that female students had higher odds of graduating on time than males was discrepant with prior research that have reported null results, or that females were more likely to drop out than males (Rumberger & Lim, 2008). When taken at face value this finding seem to conflict with much of the previous research on gender and dropout. If however, females drop out at a higher rate, then it may follow that the females who persist into and through their fourth year of high school were more resilient than their male counterparts and therefore more likely to graduate on time.

School Characteristics and School Exit Type

Despite the fact that between-school differences accounted for 25% of the variance in school exit type, the inclusion of the available level-2 measures of characteristics of the schools that students attended in their first-freshmen year did not explain any additional variance in school exit type after controlling for student-level factors. This finding contradicts prior research that has reported direct relationships between school-level concentrations of student characteristics and dropout or on-time graduation (Subedi & Howard, 2013; Rumberger & Palardy, 2004; Saunders et al., 2008). Previous studies have included fewer individual and school-level factors or larger samples at both levels-1 and -2 than were included in the current study (Subedi & Howard, 2013; Saunders et al., 2008). It is necessary to consider the possibility—given the level-2 sample size of 40 for research question 2— that the analyses did not have sufficient power to detect differences in school exit type stemming from school-level concentrations of student characteristics.

It is also possible that the null findings were related to methodological differences between prior studies and the current study. Most prior studies reporting significant effects assessed characteristics of the school that the student was enrolled in at the time of dropout or graduation (e.g., Rumberger & Palardy, 2004; Subedi & Howard, 2013). In the present study, level-2 measures of school characteristics were calculated based on the school a student attended during their final enrollment of their first-freshman year. This decision was made in order to emulate the information that district staff would have available to assess a student's odds of on-time graduation at the end of the student's first-freshmen year. School changes that occurred between the end of years one and four may have contributed to the differences between the current study results and prior findings.

Limitations and Strengths

Multiple limitations that affected the current study should be addressed in future studies. The sample for the current study was limited to a single mid-sized urban school district, potentially limiting the generalizability of the results. Further, the individual student data collected by the Maryland Longitudinal Data System Center were provided by MSDE, that collected data from local education authorities for students attending publicly funded schools, thus the results might not be generalizable to students attending private schools.

Multiple potential explanatory variables or confounders that may influence on-time graduation are not regularly collected by schools and were therefore not available for the current study. The legislation that created the MLDSC explicitly excluded the collection of multiple relevant factors, such as school health records or behavior data. In addition, the data did not include information regarding student sexual orientation or gender identity. Other important factors such as parental income assistance, housing situation, and family structure were not

available in the data. Consequently, it was not possible to ascertain whether students were related or shared a household, introducing a possible source of bias.

No data was available for residential mobility or other factors that could provide insight into the reasons that students in the study sample changed schools. It is possible—depending on the precipitating factors—that a school change could have a positive or a negative relationship with student achievement. Without the ability to differentiate between positive and negative moves, the overall relationship between student mobility and achievement may be diminished. In addition, between-school changes that occurred after SY 2010-2011 (year 1)—which were not accounted for in the analyses—may have contributed to the null findings for level-2 measures of school characteristics.

The current study had a level-2 sample size of 40 schools. According to Maas and Hox (2005), a level-2 sample size greater than 30 is sufficient to produce unbiased estimates of regression coefficients, variance components, and standard errors of regression coefficients. Under these conditions, however, the standard errors of level-2 variances may be underestimated by as much as 15% (Maas & Hox, 2005). This was addressed by adjusting the p-value required to reject the null hypothesis ($\alpha=.011$). However, given the lack of prior literature specific to persisters—and scarcity of multilevel models examining on-time graduation—it was not possible to estimate the sample size required to detect effects for the level-2 covariates included in the model. As such, null results for level-2 parameters should be interpreted with caution (McNeish & Stapleton, 2014).

Despite the limitations described above, the present study has several strengths. The phenomenon of persisting has been understudied in the existing literature. This is among one of the first studies to examine the factors related to on-time graduation for students who persisted

through their fourth year of high school but did not earn a diploma. In addition, previous studies examining factors associated with non-graduation have focused almost exclusively on student-level data. The inclusion of school-level factors contributes to the existing research knowledge by examining the influence of the educational context on the odds of on-time graduation. Finally, the current study was designed to focus on malleable factors using data that schools regularly collect. Using data that are routinely collected by the district provides important benefits for the implementation of any implications reported here, as tests of changes that might result from an intervention would not require the collection of additional data.

Implications for Practice

Recent national data suggest that more students are persisting through four years of high school without earning a diploma than are dropping out (Kena et al., 2015). Many of the previous efforts to improve graduation rates have not considered persisters, focusing instead on student dropout (Rumberger & Lim, 2008; Zaff et al., 2016). This omission signifies a missed opportunity to develop intervention strategies that explicitly account for the unique features of persisters. Chiefly, their continued engagement with the school system. Two-thirds of the persisters in this sample enrolled for a fifth year of high school at BCPSS (66%), however less than a quarter of persisters earned a high school diploma or a GED by the end of the fifth year (~24%), suggesting that being a persister indicates a high risk of not graduating at all.

A renewed focus on promoting high school graduation—that is inclusive of persisters—should include efforts to cultivate a school environment and programming that leverages the continued engagement exemplified by persisters, and develop programming that strives to close the gap between persisting and graduating. The findings presented here suggest that future efforts

to promote high school graduation should be inclusive of students persisting through their fourth year of high school without earning a diploma.

Student-level Factors. The present study identified several student-level factors, which contributed to the odds of persisting versus on-time graduation. School staff and policymakers could use indicators identified herein to design a multi-tiered intervention approach to support graduation among persisters and students with increased odds of persisting. This could include the development of innovative school-wide policies, individualized academic supports, as well as case management and behavioral interventions.

At the end of the first-freshmen year indicators such as below average attendance or not passing an high school assessment could be used to identify students who are at increased risk of poor outcomes. Such students should be provided with the opportunity to meet with a school social worker or counselor and receive additional academic supports and case management as needed. For example, on-time graduates attended about five more weeks of school in their first-freshman year than persisters did, suggesting that interventions to support increased attendance early in a student's high school career may be a particularly robust path to promoting on-time graduation. In addition, counselors and social workers should check-in with these students throughout their high school career to ensure they are making satisfactory progress towards graduation.

One in five (19%) 4-year persisters earned a high school diploma by the end of the fifth year. This highlights both the promise engendered by the continued behavioral engagement exemplified by persisters, as well as the need for targeted services to address the unmet needs of the more than three quarters of persisters (~76%) who did not earn a diploma or a GED by the end of their fifth year. The low rate at which persisters earned a GED (<5%) or participated in

the workforce (56%) suggests that many of the persisters who do not go on to earn a diploma in the fifth year may also benefit from additional support. This could include collaborating with state or community agencies to provide workforce training or internships that could help improve workforce participation for persisters who do not earn a high school diploma or GED.

School-level Factors. Previous research has not provided adequate guidance as to whether efforts meant to increase graduation rates should focus on the student or the school for intervention. This current study found that a quarter of the variance in school exit type was due to differences between schools. There was a clear pattern of performance across high schools with some performing above the district average and some underperforming. This supports the multi-tiered approach proposed by Rumberger (2011) that would include both individual supports along with efforts to shape the educational environment in a manner that promotes on-time graduation.

Implications for Policy

The passage of Every Student Succeeds Act (ESSA; P.L. 114-95) in December of 2015 signaled a major shift in education policy specific to school improvement (Dynarski, 2015). The findings presented here directly inform current and ongoing modifications to school accountability and high school graduation policy driven by ESSA. For example, school turnaround is a critical piece of ESSA that requires states to develop a program of research and intervention strategies to address the needs of the lowest-performing 5% of schools. As evidenced by Figure 2 (above), which presented the ranked school effects relative to on-time graduation, findings from this or similar studies could help policy makers to identify schools that are both under- and over-performing in terms of promoting on-time graduation. This information

could help policymakers identify practices that contribute to success in model schools and develop programming to support the schools that require intervention under ESSA.

Implications for Research

The extant research on high school graduation and dropout has not adequately addressed the phenomenon of persisting, wherein students persist into and through their fourth year of high school without earning a diploma. Instead, previous studies have mostly focused on exploring factors related to student dropout, and to a lesser extent on-time graduation. This gap in existing research highlights the need for additional study to replicate and expand on the findings presented here. Specifically, there is a need for additional inquiry to identify school-level factors that drive between-school variation in student outcomes, including rigorous research on the theoretical conceptualization and measurement of such factors.

The finding that a large proportion (25%) of the student-level variation in school exit type was due to between-school differences suggests that future research examining on-time graduation would benefit from a consideration of institutional factors that may relate to academic success. This could include a more detailed study of the underlying mechanisms that drive school-level variance in school exit type. For example, a more detailed study of student transcripts could uncover between-school variation in process factors – such as course-specific credit accumulation and exit requirements – that are impeding student progress toward on-time graduation. Conversely, future studies could examine school-level variation in the percent of students that were able to catch up and graduate on time, despite being behind in credits when they began their fourth year.

Future studies exploring the relationship between school characteristics and on-time graduation should account for school changes that occur in the second, third, and fourth years of high school. This may include cross-classified longitudinal models that can partition the variance explained by differential exposure to school environments that result from between-school mobility. In addition, the counterintuitive result for the student-level measure of mobility suggests the need for a more detailed examination of the reasons that students are changing schools. It is plausible that in some cases mobility is a function of students, or their families, explicitly seeking out schools that provide a more supportive or academically enriching environment; suggesting the presence of a cross-level interaction between mobility and family involvement or other level-2 factors. However, changing school more than once in an academic year may signal the presence of other risk factors such as changes in family structure or economic instability. As such, an analysis that accounted for the frequency of school changes may identify an inverted u-shaped relationship between mobility and on-time graduation.

The ESSA legislation includes a section titled “Innovation Research” that allocates funding for developing and testing scalable interventions to address the needs of the lowest-performing 5% of schools in each state (Dynarski, 2015). At present, there is little evidence that could be used to endorse or support any of the school-level strategies currently employed to improve graduation rates in the lowest performing schools (Zaff et al., 2016). As such, researchers should continue to investigate factors that may present opportunities for school-level intervention, work to establish the relationships among student- and school-level factors as they relate to on-time graduation, and test for the presence of causal relationships.

Continued research should pay attention to how high school exit is defined and draw comparisons between dropouts, persisters, and on-time graduates when possible. Such studies

should include analyses comparing graduation outcomes across gender in order to dig deeper into the discrepancy between the current study's findings positive finding for females and previous research findings that females were more likely than males to drop out. Future studies could also examine whether and how the timing and type of high school exit impact later outcomes across the life-course. Students who do not earn a high school diploma in four years are not a homogenous group. They may go on to earn a GED, graduate in their fifth year or earn a diploma through an adult education program. Although students are less likely to earn a diploma after their fourth year of high school, it is not clear whether earning a diploma in the fifth year has any long-term impact on distal outcomes, such as post-secondary success or engagement in the workforce. Thus, future research should examine if and how persisting affects student outcomes as they transition into young adulthood.

Conclusion

On-time graduation should be understood as a function of students within their academic environments. There is a need for additional examination of the school-level factors that may provide an opportunity for intervention. Further study in this area should consider institutional practices that promote positive working alliances between families, and school-based staff. In particular, more information is needed to understand the mechanisms through which such relationships promote positive student outcomes.

The present study explored factors related to on-time graduation from an individual and organizational perspective for a population of students who have been largely overlooked in the literature. Using available administrative data, student- and school-level factors, drawn primarily from the literature on dropout, were entered into a succession of multilevel logit models to test their relationship with the odds of on-time graduation and persisting among students in their

fourth year of high school. The current study identified student- and school-level factors that could be used to inform interventions that promote on-time graduation among students that might otherwise persist through their fourth year of high school without earning a diploma. This has important research, policy, and practice implications; chiefly that future efforts to promote high school graduation should be expanded to include persisters.

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Table 1

Results of the Chi-Square Test of Independence for Categorical Student Factors (N=4,190)

		Persisters		On-time Graduates		χ^2	<i>p</i>
		<i>f</i>	%	<i>f</i>	%		
Total		926	22	3,264	78		
Gender	Female	356	16	1,840	84	92.953	<.0001
	Male	570	29	1,424	71		
Race	Black	853	23	2,882	77	10.875	0.001
	Other Race	73	16	382	84		
Special Education	Yes	227	35	421	65	74.447	<.0001
	No	699	20	2,843	80		
Free and Reduced-priced Meals	Eligible	798	25	2,450	75	51.144	<.0001
	Not Eligible	128	14	814	86		
Between-school Mobility	Changed Schools	136	36	237	64	49.049	<.0001
	No Change	790	21	3,027	79		
Passed at Least One High School Assessment	Yes	553	17	2,701	83	665.857	<.0001
	No	373	40	563	60		
Promoted	Promoted	554	16	2,999	84	574.914	<.0001
	Not Promoted	365	58	265	42		

Note. All student-level characteristics are calculated based on the student's status at the end of the 2010-2011 school year.

Table 2

Results of the T-tests for Independent Samples for Continuous Student-level Factors (n=4,190)

	Persister		On-time Graduate		<i>df</i>	<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Age	14.960	.700	14.620	.546	1261	13.64	<.0001
Attendance in Weeks	28.959	6.456	33.710	2.845	1029	-21.8	<.0001

Table 3

Summary of Results for the Multilevel Logit Models Fitted to Evaluate the Contributions of Student and School-level Factors on School Exit Type (N=4,190)

	Unconditional Model (RQ1) [‡]			Student-level Model (RQ2a) [‡]					Student & School-level Model (RQ2b) [‡]			
	β	SE	p	β	SE	p	OR	95% CI ^b		β	SE	p
								Lower	Upper			
Fixed Effects ^a												
Intercept	1.354	.176	7.70	-2.271	1.385	.109				-.272	1.713	.875
Student Characteristics												
Age				-.185	.078	.018	.831	.714	.969	-.182	.078	.020
Female				.677	.099	<.0001	1.967	1.621	2.387	.662	.102	<.0001
Black				-.040	.174	.819	.961	.684	1.351	.019	.178	.916
Special Education				-.029	.122	.814	.972	.764	1.235	-.034	.123	.779
Free & Reduced Meals				-.293	.130	.025	.746	.578	.963	-.284	.131	.030
Weeks Attended				.159	.014	<.0001	1.172	1.140	1.205	.162	.014	<.0001
Mobility				.324	.159	.041	1.382	1.013	1.887	.368	.161	.023
Promoted				.764	.126	<.0001	2.147	1.678	2.746	.758	.129	<.0001
Passed HSA				1.164	.105	<.0001	3.203	2.605	3.939	1.156	.109	<.0001
School Characteristics												
%Black										-.077	.059	.195
%Female										.028	.044	.527
%Promoted										-.041	.065	.528
% Mobile										-.264	.138	.055
%Passed HSA										-.080	.074	.281
School Size										-.015	.014	.276
Covariance Parameters												
Intercept	1.112	.275	<.0001	.348	.103	<.0001				.357	.107	.001

a. The reference category is 2.00: On-time Graduate.

b. Confidence Interval for the Odds Ratio.

Note. ‡:(-2ll₍₂₎ = 3724.140); †:(-2ll₍₁₁₎ = 3126.910, $\chi^2_{(9)} = 597.230$, $p = <.0001$); ‡:(-2ll₍₁₇₎ = 3119.89, $\chi^2_{(6)} = 7.020$, $p = 0.319$)

Table 4

Selected Descriptive Statistics for High School Enrollment, Achievements, and Workforce Participation in the Year 5 (SY 2014-2014)

	Persisters (n=926)		On-Time Graduates (n=3264)	
	<i>f</i>	%	<i>f</i>	%
Enrolled in BCPSS High School	609	66		
5-Year Graduate	174	19		
Earned GED**	*	<5		
Participated in Workforce	516	56	2,480	76

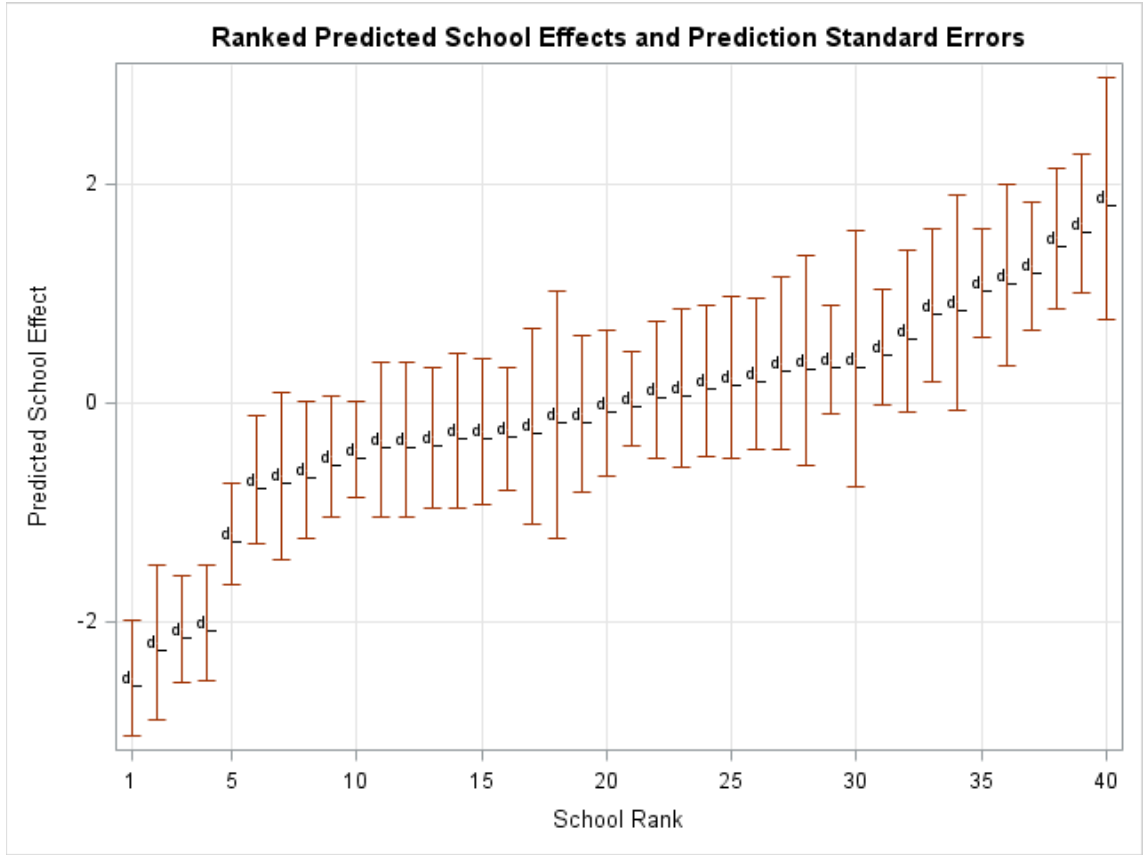


Figure 1 Illustration of the Random Intercept and Predicted Standard Errors for On-time Graduation for Public High Schools in the Baltimore City (k=40)

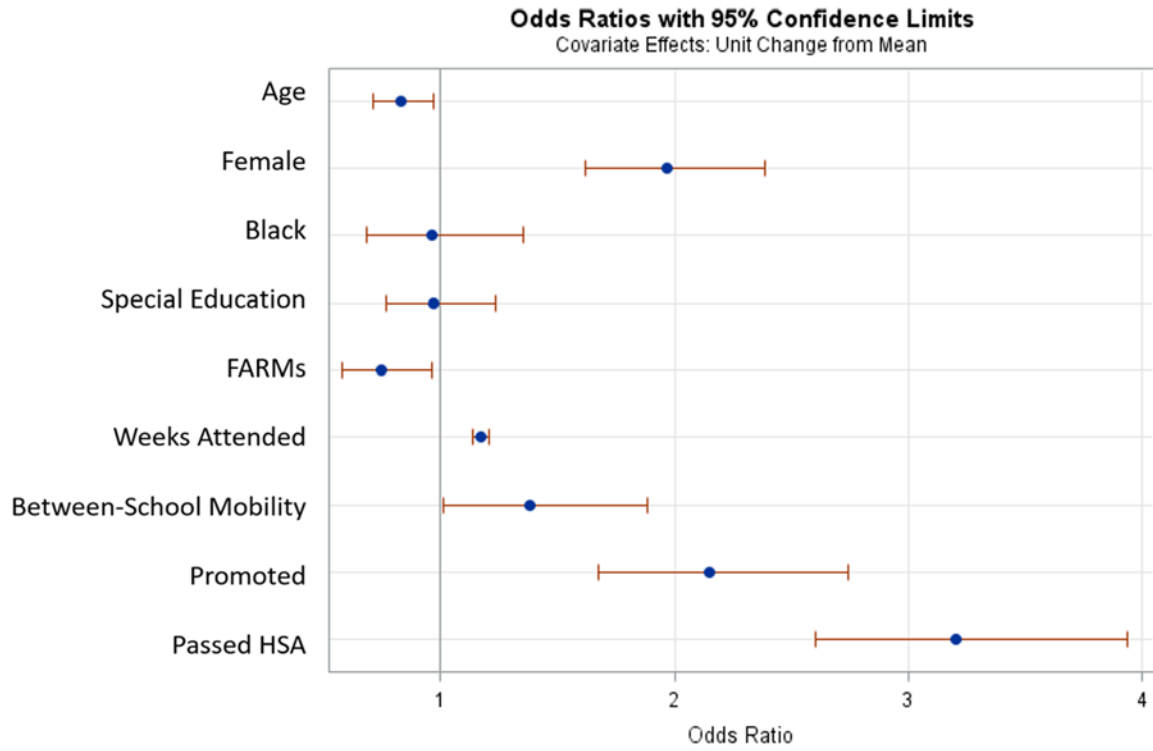


Figure 2 Illustration of the Odds Ratios and 95% Confidence Intervals of the Contribution of Student-level Factors on Exit Type (N=4,190)