Author: Angelica James-Garner, Ph.D.

Key Findings

The current study examines the 2016 cohort to determine which middle school factors were most predictive of dropping out of high school for this cohort.

- Males were 1.6 times more likely to drop out than females
- Economically disadvantaged students were 3.5 times more likely to drop out than non-economically disadvantaged students
- Overage for grade (OAG) students were 1.4 times more likely to drop out than students who were not OAG
- Chronically absent students were approximately 2 times more likely to drop out than non-chronically absent students
- Students who failed two or more core courses over their cumulative time in middle school were approximately 2 times more likely to drop out than students who failed fewer or no courses
- Students who were suspended or expelled four or more times during middle school were 3.7 times more likely to drop out than students who were suspended or expelled fewer times or not at all
- Students with enrollment gaps of three or more days were 2.4 times more likely to drop out than students with less of an enrollment gap or students who remained continuously enrolled

Literature Review

Early Warning Indicators (EWIs) are markers that identify students who are moving towards thresholds of performance indicating they are off-track for graduating on time. Many districts have used EWIs to develop Early Warning Systems (EWSs) that "flag" at-risk students based on common indicators (Bruce, Bridgeland, Fox, & Balfanz, 2011). While the specific benchmarks for these indicators can vary across school districts, they usually include attendance, behavior, and course performance. Below is a review of how various districts have used EWIs to predict and prevent dropping out.

Using Credits and Course Failures to Predict On-Time Graduation

In 1999 the Consortium on Chicago Research developed an indicator to gauge whether students made sufficient progress in their first year of high school to be on-track to graduate within 4 years (Allensworth & Easton, 2005). The Consortium considered ninth graders on-track if they had completed enough credits by the end of the year to be promoted to the 10th grade, and had failed no more than one semester of a core subject area (Allensworth & Easton, 2005).

The first component of the on-track indicator was the number of credits earned. Chicago Public Schools (CPS) requires students complete 24 credits to graduate. The Consortium found that the more credits students earned in their freshman year, the more likely they were to graduate in four years, with 5

credits being the minimum threshold. Among the students who entered ninth grade in 2000, 86% of those who took seven credits in their freshman year graduated within 4 years. Seventy-one percent of students who took six credits (the minimum needed each year to graduate in four years), and 40% of students who took five credits (the minimum needed to be promoted to the 10th grade) graduated within 4 years (Allensworth & Easton, 2005).

Regarding core course failures, the Consortium found that this indicator was a strong predictor of graduation rates. Eighty-three percent of students who earned no F's in core courses during their freshman year graduated within four years. That rate dropped to 60% when students failed just one core course and to 44% when they failed two. Additionally, irrespective of a student's academic standing upon entering high school, core course failures significantly affected students' abilities to graduate on time. Students in the top quartile of their elementary school class who failed two semester courses in their freshman year were much less likely to graduate than were students in the bottom quartile (Allensworth & Easton, 2005).

In a subsequent study, the Consortium explored additional indicators to determine which aspects of being off-track made students less likely to graduate, and whether "more nuanced indicators of course performance—such as number of course failures, GPA, or absences—might be better predictors of eventual graduation" (Allensworth & Easton, 2007, p. 3). The Consortium found that poor attendance "substantially reduced" the probability of graduating on time (p.4). In the 2000–01 cohort, only 63% of students who missed 5 to 9 days graduated on time, compared to 87% of those who missed less than 5 days. However, by the end of the first term, GPA and course failures were slightly better predictors of graduation. Specifically, GPA was the best indicator for predicting non-graduates. Ninety-seven percent of students with a 3.5 GPA in their freshman year graduated within four years, 86% with a 2.5 GPA graduated on time, while 72% with a 2.0 GPA accomplished this. When GPAs dropped to 1.0, only 28% of students graduated within four years. Naturally, "GPAs are related to course failures because failures are part of the calculation of students' GPAs" (Allensworth & Easton, 2007, p. 8). Because students need to accumulate a certain number of credits to earn a diploma, course failures are more directly tied to graduation than GPA (Allensworth & Easton, 2007).

The Effectiveness of Attendance, Behavior, and Course Failures in Predicting Dropouts

The Center for Social Organization of Schools at Johns Hopkins University conducted an analysis of early warning indicators of dropouts for the Tennessee Department of Education (Balfanz, Wang, & Byrnes, 2010). The Center used longitudinal student data from the state department of education's student management system to "develop a parsimonious set of indicators that captures the majority of dropouts from the school system" (p. 4). The data tracked the 2005–06 cohort of 17,678 first-time ninth graders from seven districts: Cannon, Davidson, DeKalb, Fayette, Monroe, and Sequatchie counties, and Memphis City Schools (Balfanz, Wang, & Byrnes, 2010).

The authors initially explored various levels of academic behaviors or characteristics and their relationship to dropping out, including attendance, suspensions and expulsions, course failures, mobility between Tennessee schools, and performance on standardized tests (Balfanz, Wang, & Byrnes, 2010). They categorized students based on the percentage of students with each

characteristic that dropped out, as well as the percentage of total dropouts who possessed each characteristic. The most notable findings were related to attendance, suspensions, and course failures. Thirty-six percent of students with an attendance rate less than 85% dropped out, while 45% of total dropouts possessed this characteristic. Thirty-one percent of students with two or more suspensions went on to drop out, while 34% of total dropouts had been suspended two or more times. Finally, 35% of students with two or more course failures dropped out, while 46% of total dropouts failed two or more courses (Balfanz, Wang, & Byrnes, 2010). The authors then chose these three indicators for additional analysis because of their "mix of accuracy (a high percentage of students with the indicators dropped out) and yield (a high proportion of all dropouts had these indicators) (Balfanz, Wang, & Byrnes, 2010, p.9). Based on logistic regression analysis, they reported that including all three indicators in an Early Warning System would be a "more effective method of identifying and reducing the total number of dropouts through intervention, as opposed to the use of any one single indicator" (p. 10).

While attendance, behavior, course credits and course failures have predictive power for high school students, several districts have sought to determine whether students demonstrate at-risk behaviors in earlier grades. Below are the results of these studies.

The Case for Middle School EWIs

Approximately Half of Philadelphia's High School Dropouts Could Be Identified in Eighth Grade

In an attempt to address Philadelphia's dropout crisis, Neild and Balfanz (2006) examined trends in cohort graduation and dropout rates from the class of 2000. The authors found that 45% of the first-time freshman dropped out of school. To determine which factors were most predictive of dropping out, they examined eighth grade data for this cohort. They reported, "Eighth graders in this cohort who had lower attendance, weaker test scores, who failed core academic courses, were overage for their grade, and/or who were male were more likely to drop out of school. Each of these factors exerted a statistically independent effect on the odds of dropping out" (Neild & Balfanz, 2006, p. 28). However, two factors provided at least a 75% probability of dropping out: attendance and course failure. Seventy-eight percent of eighth graders who attended school less than 80% of the time eventually dropped out of school, while 77% who failed mathematics and/or English dropped out. Based on these criteria, the authors found that approximately half of the district's dropouts could be identified in eighth grade (Neild & Balfanz, 2006).

In a separate analysis, Neild, Balfanz, and Herzog (2007) studied the cohort of students who entered sixth grade in 1996 (class of 2002) to determine their dropout status six years later. The authors found that students with any of the following behaviors had at least a 75% probability of dropping out of high school: a final grade of F in mathematics or English, less than 80% attendance rate for the year, or a final behavior mark of "unsatisfactory" in at least one class.

In 2009, Balfanz submitted a brief drawing on "more than a decade of research and development work at the Center for the Social Organization of Schools at Johns Hopkins University" (p. 3). The

research explored the impact of focusing on interventions in middle grades (defined as fifth through eighth grade) as a means of closing the achievement and graduation gap. In conjunction with the Philadelphia Education Fund, they followed "several cohorts of Philadelphia students from sixth grade through one year past on-time graduation" to answer the following question: "How early in the middle grades could we see clear signals that students had fallen off the path to high school graduation?" (Balfanz, 2009, pp. 3-4). They found that sixth graders who failed math or English/reading, had an attendance rate of less than 80% or received an unsatisfactory behavior grade in a core course had only a 10% to 20% chance of graduating on-time.

Approximately 71% of Non-Graduates Showed Signs of Being Off-Track in Sixth Grade in Baltimore City Schools.

Baltimore Education Research Consortium (BERC) tracked Baltimore City Schools' 2000–01 sixth grade students (Class of 2007) to determine whether they could accurately identify dropout indicators for this cohort (Baltimore Education Research Consortium, 2011). Additionally, they examined a more recent cohort of sixth graders in 2008–09 (Class of 2015) to determine if the prevalence of early warning indicators changed over time. The Consortium used logistic regression to identify the following predictors of non-graduation:
- chronic absence (missing 20 or more days of school),
- failing English, or Math, or both and/or a failing average of English, Math, Science, and Social Studies,
- being at least one year overage (suggesting an earlier retention), and
- being suspended for three or more days (Baltimore Education Research Consortium, 2011).

Approximately 29% of chronically absent sixth grade students graduated within one year of their expected graduation date compared to 70% of those who missed 10 days or less. Regarding course failures, only 31% of sixth graders who failed English/reading graduated within one year, while only 23% who failed math did, and only 19% who failed both English and math achieved this goal. Being overage for grade also adversely affected students' likelihood of graduating on time. Only 24% of sixth grade students who were one or more years overage and 8.5% of students two or more years overage for grade graduated within one year of their expected date (Baltimore Education Research Consortium, 2011).

Unlike the other indicators, BERC found that suspensions were "not a strong enough predictor of eventual dropout to be classified as an Early Warning Indicator" (p. 4). While 59.4% of students who were never suspended graduated, 29.4% who had been suspended three or more days graduated within one year of their expected graduation date.

While the presence of just one indicator reduced the probability of graduating by almost 20%, having multiple indicators reduced the probability by approximately 48%. Approximately 71% of students with no indicator graduated within one year of expected compared to 50.7% of students with one indicator, and 36.4% of students with one or more indicators graduated (Baltimore Education Research Consortium, 2011).

Finally, BERC looked at the students who failed to graduate within one year of their expected graduation date to see which indicators they displayed. The most prevalent indicator among sixth graders was chronic absenteeism. Additionally, the Consortium found that while 29.2% of non-graduates had no indicators in sixth grade, 70.8% were already showing signs of being off-track (Baltimore Education Research Consortium, 2011). However, the Consortium reported that subsequent analyses indicated that most of the students with no indicators in sixth grade had developed them by ninth grade (Baltimore Education Research Consortium, 2011). This illustrates the importance of developing and monitoring indicators as early as middle school and the first year of high school (Baltimore Education Research Consortium, 2011).

EWIs aid Montgomery County Public Schools in potentially identifying nearly 80% of the students who will eventually drop out as early as first and third grade, and nearly 90% of dropouts in sixth and ninth grade.

Montgomery County Public Schools (MCPS) followed 11,241 class of 2011 students to determine how early in school dropout indicators manifested. The study sought to explore the attendance, behavior, and coursework patterns of students who eventually dropped out of high school, as well as the likelihood of students dropping out for each time point based on those patterns. The researchers chose specific marking periods for first, third, sixth, and ninth grade students based time in school, as well as research about onset of academic performance problems and disengagement. They analyzed the results by, "regressing the likelihood of dropping out of high school on each of the EWIs by grade and marking period" (West, 2013, p. v). Below are their findings.

Attendance
A higher percentage of dropouts were absent 3 or more days than were non-dropouts in every grade examined. Additionally, first graders who were absent from school nine or more times were twice as likely to drop out of high school as students who missed fewer than nine days. Third graders who were absent from school three or more times were twice as likely to drop out of school as those who missed school less than three times. Finally, missing class three or more times doubled the odds of dropping out for 6th graders and tripled the odds for 9th graders.

Behavior
MCPS used both in and out-of-school suspensions as their behavior indicator, and for third graders, they included not completing homework on time. They found that for first graders, neither in- nor out-of-school suspensions nor the homework indicator was related to dropping out. However, the presence of the homework indicator in third grade more than doubled the odds of students dropping out in high school. Sixth graders who were suspended were more than three times as likely to drop out as students who were not suspended. Lastly, getting suspended in the ninth grade nearly doubled the odds a student would drop out compared to students who were not suspended.

Coursework

Substantially more dropouts had course failures in early grades than did non-dropouts, and almost all dropouts failed math and/or English in ninth grade. Being below grade level in reading and/or mathematics in first and third grade more than doubled the odds of students dropping out. Receiving a D or below in math and/or English increased the odds of sixth grade students dropping out by more than half, and more than tripled the odds of ninth graders dropping out. Lastly, first graders with a GPA below 1.2 were twice as likely to drop out as those with a GPA of 1.2 or above. Third graders with a 1st marking period GPA below 3.0 doubled their odds of dropping out, while the presence of this indicator in sixth grade more than quadrupled students' odds of dropping out in high school.

The study concluded that the EWIs developed could help MCPS potentially identify nearly 80% of the students who will eventually dropout as early as first and third grade, and nearly 90% of dropouts in sixth and ninth grade.

The Current Study

SCS collaborated with UPD Consulting to develop an EWS, which went live in early 2016. The model provides "a statistically derived prediction of a student's current risk of not graduating on time (from 0% to 100%) if he/she remains on his/her current path" (Brown, 2016, p. 1). The indicators with the strongest predictive power, which are presented on the EWS dashboard are:
- cumulative credits, which UPD identified as, "by far the most predictive single indicator of graduation" (Brown, 2016, p.2),
- cumulative unweighted GPA,
- course failures,
- attendance rate,
- number of gaps in enrollment greater than 4 days,
- SPED status, and
- behind grade level for cohort.

However, this model focuses on identifying at-risk high school students. Because the research has revealed that many students begin showing signs of academic disengagement as early as sixth grade, the researcher attempted to identify at-risk middle school indicators.

Method

The population consisted of students from the 2016 cohort, which is the group of students who entered ninth grade in 2012 and were expected to graduate in 2016. The sample only includes students who were enrolled in the district every year since sixth grade. The outcome variable in this study was whether or not middle school (defined as sixth through eighth grade) students dropped out of high school versus graduating on time or remaining enrolled. Table 1 presents dropouts' demographic characteristics.

Table 1

Dropout Rates by Demographics, 2016 SCS Cohort

Characteristic	# of Students w/ Characteristic	% of Cohort w/ Characteristic	# of Actual Dropouts	% of Total Dropouts	% Who Dropped Out
Male	2476	49.1	156	66.1	6.3
Female	2570	50.9	80	33.9	3.1
Black	4392	87.0	214	90.7	4.9
White	234	4.6	4	1.7	1.7
Hispanic	292	5.8	9	3.8	3.1
Asian	58	1.1	2	0.8	3.4
Other	70	1.4	7	3.0	10.0
Overage	835	16.5	75	31.8	9.0
English Language Learners (ELL)	173	3.4	8	3.4	4.6
Special Education (SPED)	681	13.5	53	22.5	7.8
Economically Disadvantaged (ED)	4443	88.0	232	98.3	5.2
Total	5046	100.0	236	100.0	4.7

Most of the dropouts were male (66.1%); however, only 6.3% of male students in the cohort eventually dropped out. Similarly, while most dropouts were Black (90.7%), only 4.9% of Black students dropped out. Approximately 32% of dropouts were overage for grade, and only 9.0% of overage for grade students eventually dropped out. Less than a quarter of dropouts (22.5%) were classified as special education (SPED) students, while 7.8% of SPED students dropped out. Finally, most (98.3%) dropouts were students classified as economically disadvantaged (ED); however, only 5.2% of ED students eventually dropped out.

Following Balfanz's model, the researcher first used a range of research-based indicators to determine the percentage of total dropouts who possessed certain characteristics (high yield indicators), as well as the percentage of students with these characteristics who eventually dropped out (high accuracy indicators) (Balfanz, Wang, & Byrnes, 2010). Table 2 represents the numbers and percentages of

students who displayed the selected characteristic(s) during their cumulative time in middle school. High accuracy and yield behaviors are highlighted and were used as the cut points for the logistic regression.

Table 2

Dropout Rates by Middle School Academic Behaviors, 2016 SCS Cohort

Academic Behaviors	# of Students w/ Characteristic	% Who Dropped Out	# of Actual Dropouts	% of Total Dropouts
>= 1 core course failure	655	12.8	84	35.6
>= 2 core course failures	276	18.5	51	21.6
>= 3 core course failures	114	13.2	15	6.4
>= 4 core course failures	43	9.3	4	1.7
>= 5 core course failures	4	0.0	0	0.0
Chronically absent	1323	11.6	154	65.3
>= 1 suspensions or expulsion	2321	8.3	193	81.8
>= 2 suspensions or expulsion	1481	10.6	157	66.5
>= 3 suspensions or expulsion	1047	13.4	140	59.3
>= 4 suspensions or expulsion	747	17.3	129	54.7
>= 5 suspensions or expulsion	559	19.3	108	45.8
>= 1 yr. overage for grade (OAG)	674	8.9	60	25.4
>= 2 yrs. OAG	36	5.6	2	0.8
>= 1-day enrollment gap	759	12.6	96	40.7
>= 2-day enrollment gap	565	15.0	85	36.0
>= 3-day enrollment gap	460	16.1	74	31.4
>= 4-day enrollment gap	381	17.8	68	28.8
>= 5-day enrollment gap	322	18.0	58	24.6

Results

Table 3 presents the results of the logistic regression. Odds-Ratios represent the likelihood that a student having this characteristic would drop out compared to a student who does not possess this characteristic or academic behavior. For example, males were more than twice as likely to drop out as females. Odds-Ratios of one mean the variable had no effect on the outcome. Odds-Ratios less than

one mean that a student with this indicator was less likely to drop out of high school than a student without it. For example, the odds of dropping out were decreased by a factor of 0.99 if the student was ELL versus being non-ELL. Another way of interpreting the data are to consider percentages. Every odds-ratio can be converted to a percentage simply by subtracting 1 (because 1 indicates no effect) from the odds-ratio and multiplying it by 100. For example, males were 109% (or 2.09 times) more likely to drop out than were females. Similarly, ELL students were 1% less likely to drop out than were non-ELL students. P-Values represent the significance level of each variable in the equation. A variable was a statistically significant predictor of dropping out if the p-value was .05 or below.

The *Alone* column represents the likelihood of dropping out based on each variable individually. Regardless of other variables (e.g., demographic characteristics or other indicators), students who were chronically absent were almost six times, or 485%, more likely to dropout than were students who were not chronically absent. The *With All Indicators* column represents the likelihood of dropping out in the presence of the other indicators in the model (all indicators entered simultaneously). Including all indicators in the model reduced the effect of chronic absenteeism, suggesting that this indicator was correlated with other indicators. Chronically absent students were approximately twice as likely, or 114% more likely, to drop out than were students who were not chronically absent when factoring in all indicators. Despite the reduction in the effect of chronic absenteeism, this indicator was still a significant predictor of dropping out. Finally, the *With All Controls* column displays the likelihood of dropping out for each variable, controlling for all other variables in the model. With these parameters, chronically absent students were approximately twice as likely, or 132% more likely, to drop out than were students who not chronically absent.

Table 3

Logistic Regression Results, Middle School Characteristics as Predictors of Dropping Out, SCS 2016 Cohort

Variable	Alone			With All Indicators			With All Controls		
	Odds-Ratio	%	P-Value	Odds-Ratio	%	P-Value	Odds-Ratio	%	P-Value
Male	2.09	109	0.000				1.60	60	0.002
Minority	2.91	191	0.036				1.22	22	0.710
ELL	0.99	-1	0.973				1.30	30	0.498
ED	8.25	725	0.000				3.53	253	0.016
SPED	1.93	93	0.000				1.23	23	0.261
Overage	2.43	143	0.000				1.44	44	0.030
Chronically absent	5.85	485	0.000	2.14	114	0.000	2.32	132	0.000
Failing >/= 2 core courses	5.62	462	0.000	2.47	147	0.000	2.39	139	0.000
>/= 4 suspensions or expulsions	8.18	718	0.000	3.92	292	0.000	3.65	265	0.000
>/= 3-day enrollment gap	5.24	424	0.000	2.44	144	0.000	2.43	143	0.000

Since controlling for other indicators in the model eliminates the influence those indicators have on the outcome and only presents the unique influence of a chosen indicator, it is a more accurate method of identifying potential dropouts. Consequently, this section presents the statistically significant indicators in this portion of the model. Controlling for the other variables in the model, students who were more likely to dropout were:

- Male: 60% more likely than females
- Economically disadvantaged: 253% more likely than non-economically disadvantaged students
- Overage for grade: 44% more likely than students who were not OAG
- Chronically absent: 132% more likely than non-chronically absent students
- Failing two or more core courses over their cumulative time in middle school: 139% more likely than students who failed fewer or no courses

- Suspended or expelled four or more times during middle school: 265% more likely than students who were suspended or expelled fewer times or not at all
- Out of school for 3 or more days between enrollments: 143% more likely than students with less of an enrollment gap or students who remained continuously enrolled.

Because of its strong, unique effect on middle school students' likelihood of dropping out, district leaders should consider targeted interventions for students with increasing behavior problems. Additionally, considering the unique needs and challenges of economically disadvantaged students could help mitigate the effects of poverty on these students' likelihood of dropping out of high school.

References

Allensworth, Elaine. M. & John. Q. Easton. (2005). "The On-Track Indicator as a Predictor of High School Graduation." Chicago: Consortium on Chicago School Research.

Allensworth, Elaine. M. & John. Q. Easton. (July 2007). "What Matters for Staying On-Track and Graduating in Chicago Public High Schools: A Close Look at Course Grades, Failures, and Attendance in the Freshman Year." Chicago: Consortium on Chicago School Research.

Balfanz, Robert (June 2009). Putting Middle Grades Students on the Graduation Path: A Policy Brief. Westerville, OH: National Middle School Association.

Balfanz, Robert, Antonia Wang, & Vaughan Byrnes. (October 2010). Early Warning Indicator Analysis: Tennessee. Baltimore: Center for Social Organization of Schools.

Baltimore Education Research Consortium. (February 2011). Destination Graduation: Sixth Grade Early Warning Indicators for Baltimore City Schools – Their Prevalence and Impact.

Brown, Tiera. EWS Modeling Outcomes. UPD memo to Dr. Heidi Ramirez, Brad Leon, and Jessica Lotz, July 17, 2016.

Bruce, Mary, John M. Bridgeland, Joanna H. Fox, & Robert Balfanz. (November 2011). On Track for Success: The Use of Early Warning Indicator and Intervention Systems to Build a Grad Nation. DC: Civic Enterprises and Baltimore: The Everyone Graduates Center at Johns Hopkins University.

Neild, Ruth Curran & Robert Balfanz. (2006). Unfulfilled Promise: The Dimensions and characteristics of Philadelphia's Dropout Crisis, 2000-2005. Philadelphia Youth Network, Johns Hopkins University, and University of Pennsylvania.

Neild, Ruth Curran, Robert Balfanz, and Liza Herzog. (October 2007). An Early Warning System: Educational Leadership: Early Intervention at Every Age, 65(2), 28-33.

West, Thomas. (March 2013). Just the Right Mix: Identifying Potential Dropouts in Montgomery County Public Schools Using an Early Warning Indicators Approach. Rockville, MD: Office of Shared Accountability.