THE SENIOR URBAN EDUCATION RESEARCH FELLOWSHIP SERIES

Accountability and Performance in Secondary Education in Milwaukee Public Schools

Robert Meyer
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Huiping Emily Cheng

Council of the Great City Schools

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THE COUNCIL OF THE GREAT CITY SCHOOLS

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Volume II:

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The Council of the Great City Schools is the only national organization exclusively representing the needs of urban public schools. Founded in 1956 and incorporated in 1961, the Council is located in Washington, D.C., where it works to promote urban education through legislation, research, media relations, instruction, management, technology, and other special projects.

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OVERVIEW

THE SENIOR URBAN EDUCATION RESEARCH FELLOWSHIP PROGRAM

Large urban public school districts play a significant role in the American education system. In 2007-08, the largest 65 urban school systems in the country - comprising less than one half of one percent of the nearly seventeen thousand school districts that exist across the United States - educated about 14 percent of the nation's K-12 public school students, approximately one third of its African American students, a third of its English Language Learners, a quarter of its poor students, and a quarter of its Hispanic students.[1] They also employed nearly 15 percent of the nation's teaching force. Clearly, any attempt to improve achievement and to reduce racial and economic achievement gaps across the United States must involve these school districts as a major focus of action.

These school districts face a number of serious, systematic challenges. However, solutions to these problems are not always obvious, and the existing research base is not always sufficient to address them. In order to better understand the problems in urban education and to develop more effective and sustainable solutions, urban districts need a program of rigorous scientific inquiry focusing on what works to improve academic outcomes in the urban context. Moreover, in order to produce such evidence and to move public education forward generally, the standards of evidence in education research must be raised in such a way as to bring questions regarding the effectiveness of educational interventions and strategies to the fore and to promote careful scrutiny and rigorous analysis of the causal inferences surrounding attempts to answer them.

It has been argued that, in order to move such an effort forward, a community of researchers, committed to a set of principles regarding evidentiary standards, must be developed and nurtured. We contend further that, in order to produce a base of scientific knowledge that is both rigorously derived and directly relevant to improving achievement in urban school districts, this community of inquiry must be expanded to include both scholars and practitioners in urban education.

Though a great deal of education research is produced every year, there is a genuine dearth of knowledge regarding how to address some of the fundamental challenges urban school districts face in educating children, working to close achievement gaps, and striving to meet the challenges of *No Child Left Behind.* Moreover, while there is a history of "process-related" research around issues affecting urban schools, relatively few studies carefully identify key program components, document implementation efforts, and carefully examine the effects of well designed interventions in important programmatic areas on key student outcomes such as academic achievement. In sum, there is an absence of methodologically sound, policy relevant research to help guide practice by identifying the conditions, resources, and necessary steps for effectively mounting initiatives to raise student achievement.

In order to address this need, the Council of the Great City Schools, through a grant from the Institute of Education Sciences, established the Senior Urban Education Research Fellowship (SUERF) program.

The Senior Urban Education Research Fellowship was designed to facilitate partnerships between scholars and practitioners focused on producing research that is both rigorous in nature and relevant to the specific challenges facing large urban school districts. We believe such partnerships have the potential to produce better, more practically useful research in at least three ways. First, by deepening researchers' understanding of the contexts within which they are working, the program may help them maximize the impact of their work in the places where it is needed the most. Second, by helping senior staff in urban districts become better consumers of research, we hope to increase the extent to which the available evidence is used to inform policy and practice, and the extent to which urban districts continue to invest in research. Third, by executing well designed studies aimed at the key challenges identified by the districts themselves, we hope to produce reliable evidence and practical guidance that can help improve student achievement.

1 Council of the Great City Schools (2010). *Beating the Odds: An Analysis of Student Performance on State Assessment and NAEP.* Results from the 2008-09 School Year. Washington, DC.

The primary goals for the Senior Urban Education Research Fellowship are to:

- promote high quality scientific inquiry into the questions and challenges facing urban school districts;
- facilitate and encourage collaboration, communication, and ongoing partnerships between senior researchers and leaders in urban school districts;
- demonstrate how collaboration between scholars and urban districts can generate reliable results and enrich both research and practice;
- produce a set of high quality studies that yield practical guidance for urban school districts;
- contribute to an ongoing discussion regarding research priorities in urban education; and
- promote the development of a "community of inquiry", including researchers and practitioners alike, committed to both a set of norms and principles regarding standards of evidence and a set of priorities for relevant, applied research in urban education.

The following volume of the *Senior Urban Education Research Fellowship Series* documents the work of Dr. Robert Meyer, Dr. Bradley Carl, and Huiping Emily Cheng, working in collaboration with the Milwaukee Public Schools (MPS). Both the research and reporting is the sole intellectual property of Dr. Meyer, and reflects his personal experience and perspective as an education researcher working in collaboration with MPS.

Dr. Meyer and his team have produced strong new work in the area of "early warning systems" for identifying students at risk for adverse high school outcomes. We are particularly pleased to see how the relationship between the Value Added Research Center at the University of Wisconsin-Madison has grown, and is continuing to grow. Their experience working hand in hand with the district, and the district's consistently active and open support of this work, offers us one of the best models for district-researcher collaborations in the country.

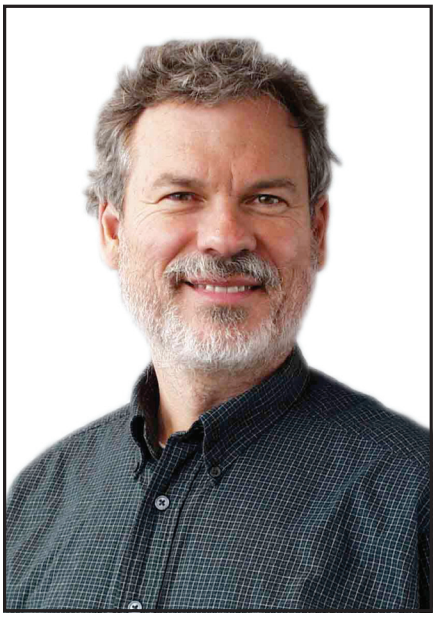
Their extensive understanding of the patterns of academic failure within the district-- as well as the data needs of MPS to address these challenges-- have led to some particularly exciting innovations in this area. For example, they have built on the "on-track indicator" work of the Consortium on Chicago School Research to create a new measure-- the "Total Quality Credits" indicator, a continuous variable of student achievement that measures not only whether a student is "on track" to graduate or not, but how far on or off track they are by the end of their first year of high school. This measure provides the district with crucial information for understanding a student's educational progress in more detail.

The research team also takes a step beyond high school graduation to illustrate that post-secondary outcomes-- the skills with which students graduate and rates of enrollment in college-- are as relevant and important a target for district efforts as high school graduation. While they acknowledge that the currently available measures of post-secondary outcomes are insufficient in MPS-- i.e., enrollment in college rather than college persistence and graduation -- this push for farther-reaching measures of how well our public schools are serving students is both timely and important. We hope you will find it interesting and relevant to your own work.

Thank you.

Michael Casserly
Executive Director
Council of the Great City Schools

ABOUT THE SENIOR URBAN EDUCATION RESEARCH FELLOW



Dr. Robert H. Meyer is director of the Value-Added Research Center (VARC) within the Wisconsin Center for Education Research (WCER) at the University of Wisconsin-Madison. Before joining WCER, Meyer was on the faculty of the University of Chicago (Harris School of Public Policy Studies) and the University of Wisconsin (Economics Department). Meyer is known for his research on value-added modeling and evaluation methods. Over the last decade and a half, Meyer has worked closely with districts and states to develop and apply innovative statistical methods. He has conducted major statistical evaluations of programs and policies such as SAGE (the Wisconsin class-size initiative), systemic reform in Texas, integrated versus traditional mathematics, and professional development, and other math and science reforms. At the other end of the evaluation spectrum, Meyer has worked with numerous districts and states, including Minneapolis, Milwaukee, Chicago, Michigan, Minnesota, and Wisconsin, to develop and implement custom value-added indicator systems and longitudinal data warehouse systems. He is a Principal Investigator on the Milwaukee and Chicago Value-Added Projects and a Technical Assistance Director for the Center for Educator Compensation Reform for the federal Teacher Incentive Fund (TIF) project.

ABOUT THE RESEARCH PARTNERSHIP

THE HISTORY AND EVOLUTION OF THE MPS/ WCER RESEARCH COLLABORATION

The Senior Urban Education Research Fellowship has provided a key opportunity to build upon an already-strong research partnership between the Milwaukee Public Schools (MPS) and the Wisconsin Center for Education Research (WCER). As a part of UW-Madison's School of Education, WCER provides a productive environment where scholars conduct basic and applied education research. WCER research spans the full scope of education, from the effects of infant child care and after-school programs to undergraduate and graduate curriculum reform. Housed within WCER, the Value-Added Research Center (VARC) is dedicated to developing, applying, and disseminating value-added and longitudinal research methods to evaluate the performance and effectiveness of schools and teachers, as well as educational programs and policies. Under the leadership of VARC director Robert H. Meyer, a staff of faculty, scientists, researchers, education professionals, and data system specialists provide a wide variety of cross-disciplinary expertise to allow for groundbreaking work on value-added systems, program and policy evaluation, data-driven decision making, and education reform.

With a current enrollment of some 82,000 students – making it by far Wisconsin's largest district and among the largest in the country – MPS is a natural research partner for WCER's work. The MPS/WCER research partnership dates back to collaborative work on the development of district-level standards and assessments in the mid-1990s, and expanded significantly with VARC's production of the first set of MPS value-added reports at the school and grade level for the 2001-02 school year. These reports were based upon data from the Wisconsin Knowledge and Concepts Examination (WKCE) and the *TerraNova* assessment series. MPS, along with Minneapolis and Dallas, was among VARC's first partner districts for value-added work; this work has since expanded to include two of the largest districts in the country (the New York City Department of Education and the Chicago Public Schools), in addition to nearly 40 Wisconsin districts of varying sizes above and beyond MPS (including the Madison Metropolitan and Racine Unified school districts) which collectively enroll more than 30% of the total K-12 enrollment in Wisconsin. VARC also has an ongoing contract to provide technical assistance to districts across the country that are implementing value-added as one component of teacher merit pay plans under the federally-funded Teacher Incentive Fund (TIF) program.[2]

As of this writing in the spring of 2010, VARC has recently delivered its 9th annual set of value-added reports for MPS based upon WKCE data through the 2009-10 school year. The district has continued its practice of posting all value-added reports publicly on the Web site of the Division of Research and Assessment, and has incorporated value-added data into a variety of district and school improvement initiatives. Value-added data were a major component, for example, in the selection of a group of higher-performing schools (known as Mosaic schools) which received increased autonomy in matters related to curriculum and budgets, and were also used to identify a second set of lower-performing schools that received additional targeted assistance from the district as well as the National Education Association Foundation. Value-added data are also a required component of the School Improvement Plans submitted by each school on an annual basis to identify areas of strength and weakness in terms of planning for future improvement.

With VARC's rapidly-increasing profile in terms of producing value-added information has come the realization that value-added data must be accompanied by *interpretive information and professional development* in order to be maximally useful as a school improvement tool. To this end, VARC has worked collaboratively with its research partners--including MPS-- to create to create a series of professional development materials and activities which include both on-site presentations by VARC staff to build a "train-the-trainers" model as well as on-demand content accessible through the VARC Web page.[3]

2 See http://www.cecr.ed.gov and http://varc.wceruw.org/Projects/center_educator_comp_reform.php.

3 Several of the professional development materials produced for use in MPS have been made available to other districts in Wisconsin and across the country via the "Tutorials" section of the VARC Web site; see http://varc.wceruw.org/tutorials/index.php.

ABOUT THE RESEARCH PARTNERSHIP

VARC's value-added work with MPS and other partner districts has also recently expanded to include pilot versions of value-added data based upon short-cycle (benchmark or interim) assessments administered three or four times annually, as well as selected non-cognitive measures such as attendance. There is great interest in this type of new value-added data generated from short-cycle assessments, as these data can be used far more readily for school improvement purposes than can data from summative tests due to the "time lag" involved in summative tests (in Wisconsin, for example, results from the state accountability test taken in November each year are not made available to districts until March). Short-cycle assessments also alleviate the problem of needing to apportion growth across two separate academic years, which is made necessary by mid-year testing in Wisconsin and other states.

Above and beyond foundational work with value-added indicators as described above, the MPS/WCER research partnership has expanded substantially in recent years to include a wide array of program evaluation and data-driven decision-making work, as well as efforts to build greater capacity in the areas of human capital (including district and school leadership and the district's employee performance evaluations) and performance management. In the area of program evaluation, MPS has awarded contracts to VARC to evaluate and/or design a number of major district initiatives in recent years, including:

- Read 180 (an intervention for lower-performing readers in middle and high school)
- Charter schools
- Literacy Coaches
- Supplemental Educational Services (SES) providers
- Revised principal and teacher evaluation systems
- Instructional walk-throughs
- Uses of School Improvement Plans
- Credit recovery and "Freshman Connection" programs for high school students

In the area of data usage and data-driven decision-making, MPS and VARC are collaborating on the development of an Integrated Resource Information System (IRIS), which has two related goals: to assess student, teacher, classroom, and school effects on value-added student learning gains; and to connect resources at the school, classroom, and student levels to effectiveness in improving student learning.

VARC staff also worked actively with MPS during the 2009-10 school year on a comprehensive reform of the district's employee evaluation system for principals and teachers, as well as the implementation of Performance Management principles for improvement and accountability. Specific initiatives include the implementation of the "EdStat" model for data review and continuous improvement. By focusing attention on a selected set of "Key Performance Indicators," or KPIs, and providing a regular time for district and school staff to reflect on progress along these measures, the EdStat model provides a useful new way of incorporating data into the school improvement process in MPS.

An additional, very unique aspect of the MPS/WCER relationship is the "embedded researcher" concept. Under this arrangement, which was initiated in 2005, a WCER employee splits time each week between WCER in Madison and the Division of Research and Assessment at MPS, working under the technical direction of VARC director Dr. Robert Meyer and under the functional direction of MPS director of Research and Assessment Deb Lindsey. This arrangement provides WCER with a constant presence in the state's largest school district, which is invaluable in continuing and strengthening the university-district relationship, and provides MPS with on-demand capacity in matters of research and program evaluation that is rare even in the largest urban districts. The current embedded researcher, Dr. Bradley Carl, assists MPS with ongoing initiatives such as the development and refinement of the vertical scale for the MPS benchmark assessment system as well as evaluations of MPS programs.

One of the ways in which the Senior Urban Fellowship has been particularly useful is that it has fit very nicely with, and contributed greatly to, a substantial expansion of the existing MPS/WCER research partnership to the high school level. Many of the projects noted above, from VARC's core value-added work to the specific evaluation projects undertaken by VARC staff in MPS, have appropriately focused on the elementary and middle school levels, as these have been areas of high interest to the district and have the advantage of having pre-existing data sets (often in the form of test scores) readily available for evaluation purposes. At the same time, however, there has been a greatly increased emphasis in the recent past on high school-related outcomes as a portion of the MPS/VARC research agenda, both from the district's perspective as well as VARC's. Specific examples here include the following:

- A comprehensive evaluation of MPS high schools, focusing on differences across high school types (small vs. large, charter vs. non-charter, etc.) with respect to key performance indicators including test scores, attendance, and initial postsecondary enrollment; the final report was submitted in December 2009 and presented to the MPS Board of Directors in February 2010.
- Tracking postsecondary outcomes, including initial college enrollment and rates of persistence among MPS graduates, for recent cohorts of MPS graduates
- Evaluating the impact of several new initiatives (funded by federal stimulus dollars) intended to improve outcomes for MPS freshmen, including a series of "freshman connection" activities designed to improve transitions from middle grades to high school as well as a new credit recovery project aimed at reducing the high rate of MPS students who must repeat grade 9 each year. This work, launched in late 2009, will produce an interim report in June 2010, followed by a second year of work that will end with a final project report a year later.

EXECUTIVE SUMMARY

This report summarizes work conducted to date through the Senior Urban Education Research Fellowship (SUERF) awarded by the Council of the Great City Schools to the Value-Added Research Center (VARC) at the University of Wisconsin-Madison for work in the Milwaukee Public Schools (MPS). VARC has utilized its Fellowship award, entitled "Accountability and Performance in Secondary Education in the Milwaukee Public Schools," to substantially expand an already-strong research partnership with MPS into exciting new work at the high school level.

Specifically, the SUERF award has supported two key areas of inquiry related to high school performance and accountability in MPS. The first, which is the major focus of this paper, is the development of an "early warning" system to help MPS identify middle and high school students at elevated risk of two key adverse outcomes: (a) failing to graduate from high school, and (b) graduating, but with low levels of college/workforce readiness. The second, as summarized in the Appendix, is the development of a new class of value-added performance indicators for MPS high schools, including the use of non-cognitive outcomes such as attendance to complement more traditional (test-based) value-added metrics.

METHODOLOGY

Part 1. Overview of Data Used and Challenges Encountered

A guiding principle in creating the MPS early warning system has been to gather data from multiple cohorts of first-time MPS 9th grade students and work both "backward" (e.g., into middle school) as well as "forward" (into high school) to develop predictive models for student success on the primary outcomes of interest (high school graduation and college enrollment). Assembling a full "panel" of data to describe the complete middle and high school experiences of MPS students presented a significant challenge, both because MPS data sets are somewhat limited prior to the 1998-99 school year and because this task requires nearly 10 years of data (including at least three years of middle school as well as 4-6 years of high school after accounting for student retentions). The primary solution to this problem was a recursive "data splicing" approach which relied upon complete sets of middle school outcomes for certain cohorts of students combined with different sets of complete high school outcomes for other cohorts. These disparate data sets were then linked together through the common metric of Total Quality Credit (TQC) attainment during the first year of high school, as described in more detail below. Data for the second major outcome being predicted (college enrollment) was provided by accessing National Student Clearinghouse (NSC) files, which MPS began acquiring during the 2008-09 school year.

Part 2. Data Inventory: What is Known about MPS Dropouts?

A key starting point for the design and features of the MPS early warning system was a series of descriptive findings related to MPS dropouts and graduates. This is not because the descriptive findings were surprising per se, but rather because they provide important information regarding which factors yield the greatest predictive power for understanding which students are least likely to graduate and attend college, as well as how to weight these predictors relative to one another. The key findings are as follows:

How early into their high school career do most MPS students tend to drop out?

- A relatively small number of MPS students who eventually dropped out (7.1% across the two cohorts combined) did so during their first year of high school. It is more common for MPS students to drop out during their third and fourth years of high school, although a surprising number of MPS students make it to their fifth and even sixth year of high school before dropping out. As has been observed in other cities, it appears that *dropping out of MPS as an outcome is best understood as a gradual process of disengagement and academic shortcoming that often plays out across multiple years of a student's high school career, rather than as a single catastrophic event that leads to immediate withdrawal from school.*

- Despite the fact that many MPS students persist into their fourth, fifth, and even sixth[4] year of high school before dropping out, *the largest group of dropouts in terms of students' last grade prior to dropping out was 9th graders,* who were 26.0% of all dropouts for the two cohorts combined. From a data standpoint, this confirms the need to treat grade in high school as a completely different variable than amount of time spent in high school, as many students are retained in 9th grade once, and even twice in a substantial number of cases, before dropping out.

How do eventual dropouts and graduates differ with respect to key outcome indicators during the first year of high school and middle school years?

- Students who eventually dropped out of high school had substantially lower academic performance (GPA) in core academic subjects (reading, math, science, and social studies) in their first year as 9th graders, and failed a much higher percentage of core subject courses than did eventual graduates.
- Dropouts were much more likely to have been retained in grade 9 than graduates.
- The absence rates of eventual dropouts were much higher than those of eventual graduates, both on a year-end as well as a month-to-month basis.
- Eventual dropouts as a group had higher incidences of behavioral problems than did eventual graduates, both in terms of how often they were suspended as well as the severity of the offenses committed.
- Standardized test scores for eventual dropouts were lower than for eventual graduates, although test scores provide comparatively little predictive power, particularly toward graduation as an outcome.
- Dropouts were more mobile than graduates, as measured by the frequency of month-to-month changes in enrollment during the school year, although mobility overall yielded comparatively little predictive power after other variables were controlled for.

Part 3. Creating the "Total Quality Credits" Indicator

Given the importance of the first year of high school, the utility of an "on track" measure to classify students according to credit accumulation and number of failing grades in core courses at the end of the first year was evident. However, there are two main limitations to such a measure. First, classifying students as either on-track or off-track at the end of the first year of high school, or even halfway through the year, is simply too late to prevent many students from dropping out. Moreover, this approach discards very valuable information for identifying *how far* on-track or off-track students are during or after their first year of high school. It became clear from our work in MPS that a more nuanced way of capturing the quality of students' academic experiences in addition to the *quantity* (e.g., credit attainment) was needed. Additionally, it seemed that a useful on-track/off-track measure could be replicated for school years both *prior* to and *following* the first year of high school, to both be consistent with the principle of an early warning system as well as to recognize the fact that many MPS students remain at risk despite persisting into their second year of high school and beyond.

The result of this thinking is a new measure called Total Quality Credit (TQC) attainment, which combines credit attainment and final grades into a continuous variable that can be can be used as an early warning "shortcut" to predict the most valued high school outcomes (graduation and college enrollment) based upon middle school data, rather than waiting until these outcomes actually occur among high school students up to six years after initial 9th grade enrollment. Under the two-stage recursive modeling structure, middle grades outcomes (including both academic inputs and engagement measures such

4 Most of the students who are in their sixth year of high school enrollment are students with disabilities; the Individuals with Disabilities Education Act (IDEA) stipulates that school districts are required to provide services to students with disabilities up to the age of 21.

as attendance and behavior) are used to predict TQC attainment at the end of students' first year of high school, while first-year TQC is in turn used to predict the "final" outcomes of high school graduation and initial college enrollment.[5]

Part 4. Combining Risk Factors into an Early Warning System

Having investigated the descriptive relationships that exist between individual independent variables (such as academic attainment as measured by TQC, attendance, mobility, retention, student demographics, etc.) and the desired high school outcomes (graduation and initial college enrollment), the next step was to combine these risk factors into predictive models for understanding TQC attainment at the end of the first year of high school. To this end, a series of regression analyses using first-year TQC attainment among first-time MPS 9th graders in 2005-06 and 2006-07 (combined) as the dependent variable were prepared.

Independent (predictor) variables used in the analyses include the following:

- School type from which a student "graduated" from 8th grade (K-8 vs. traditional middle school vs. middle/high school)[6]
- Grade 8 WKCE reading and math proficiency level
- Absence rates during each year of the middle grades
- TQC attainment during each year of the middle grades
- Instances of mobility during each year of the middle grades (mobile vs. not mobile)
- Retention during each year of the middle grades (retained vs. not retained)
- Suspensions during each year of the middle grades (suspended vs. not suspended)
- Student demographics (gender, race/ethnicity, ELL, special education, economic status)

FINDINGS

Thus far, three main inferential findings have emerged from our analyses, although given the interim nature of this report, we expect that additional findings of interest will emerge in the near future. These include the following:

Finding #1. ***"High yield" indicators of students at risk for dropping out of MPS and graduating with low college/workforce readiness include academic achievement (TQC), attendance, suspension, and retention/overage.***

Using regression analyses, it was possible to identify a selected set of "high yield" indicators to show in the MPS Early Warning "dashboard," which serves as the primary means through which early warning research findings are already being operationalized within the district for purposes of identifying students at risk. In the case of the MPS early warning system, regression analysis identified academic achievement (TQC), attendance, suspension, and retention/overage as the four most important predictors.

Finding #2. ***The ability to predict first year high school outcomes thus far using middle school indicators is somewhat limited. Among other implications, this suggests that the transition to high school presents a significant challenge for many middle grades students in MPS, even those with relatively high levels of performance through the middle grades.***

Another main inferential finding emerging from these analyses is that using even the most complete sets of middle school outcomes provides somewhat limited predictive power in terms of predicting end of first-year high school TQC attainment – and that having multiple years of middle grades outcomes, as opposed to just a single year (e.g., grade 8) appears to add somewhat minimal predictive power for predicting first-year TQC attainment. In other words, *many MPS students who have done reasonably well throughout middle school in terms of*

5 It should be noted that these outcomes can be thought of as "placeholders" for now, until MPS obtains sufficient data to inform the much more important outcome of college persistence and graduation.

6 This is an important consideration in MPS because the district, like several of its urban counterparts, began converting many of its traditional middle schools (serving grades 6-8) to a K-8 configuration beginning in the late 1990s. Accordingly, the question of whether school type (K-8 vs. middle) exerts any degree of measurable influence upon high school outcomes for students with similar backgrounds becomes a key policy question.

both academics and engagement (e.g., attendance and behavior) experience substantial academic deficiencies during their first year of high school.

Finding #3. *Irrespective of school type (K-8 vs. traditional middle), some MPS middle schools appear to be doing a better job than others in preparing students for the rigor of high school.*

The inclusion of school-level indicators to identify both the middle school from which each MPS student "graduated" as well as the school(s) they attended during their first year of high school also told an interesting story. While the overall (districtwide) relationship between outcomes in the middle grades and those during the first year of high school was perhaps somewhat weaker than expected, stronger relationships emerge for some schools than for others. This suggests that *some MPS middle schools are doing a better job than others in preparing students for the rigor of high school.* It may further suggest that having the right "match" of graduating 8th grade student to high school acts as a critical determinant of success at the high school level and beyond, in much the same way that the matching process of high school graduate to college has been shown to be very important as a determinant of college success.

The impact of school type and other variables of potential interest are also discussed at the end of this section.

CONCLUSION

While the research component of the MPS early warning system conducted by VARC continues, the district has already taken steps to incorporate early warning findings into "products" intended to inform district improvement efforts. MPS has developed an "early warning dashboard" at the high school level, for example, that provides up-to-date information for the four "high yield" indicators identified (TQC, attendance, suspensions, and retention/overage), with specific thresholds set for each year in high school that place a student into one of three risk categories: green (low risk), yellow (moderate risk), and red (high risk).

In addition, several policy implications and avenues for future work have emerged from VARC's early warning work in MPS. This work has contributed to a deeper understanding of the dropout phenomenon in MPS, and by knowing more about dropouts in a descriptive sense– such as when they drop out most frequently during their high school career – it is possible to design interventions to more effectively address this problem. For example, the fact that many MPS dropouts persist into well into their high school careers suggests that dropping out is best understood as a gradual process of disengagement rather than a single catastrophic event, and that efforts to better identify at-risk students based on observable outcomes during the middle grades and even the first year of high school are critical. At the same time, the fact that the modal grade for MPS dropouts is grade 9 suggests that additional programming targeted at easing the difficult transition from middle to high school is warranted, and that this programming should be informed by rigorous early warning data.

While early warning work conducted to date has been very promising, another policy implication emerging from our work is that additional research and development is clearly needed to "fine tune" the system. For example, our analysis illustrates that it is misleading to think of graduates as a single, monolithic group whose trajectories for life success are largely similar. Instead, we identify a second key outcome that should be predicted by early warning work, in addition to predicting which students are at elevated risk of dropping out: those students who are likely to graduate, but with very low levels of college and workforce readiness.

Moreover, the low predictive power of middle grades models suggests that additional data are needed in order to make these early warning models more robust. This may include developing ways of measuring key non-cognitive outcomes such as students' sense of attachment to school and the efficacy of their support networks, and perhaps also incorporating non-school predictive information such as students' health and family backgrounds.

INTRODUCTION

INTRODUCTION

OVERVIEW OF PRIOR RESEARCH AND DEVELOPMENT EFFORTS

Early warning system development in MPS has benefited greatly from prior research in this area. A general consensus has emerged from prior research (Jerald, 2006; Heppen & Therriault, 2008, Kennelly & Monrad, 2007; Balfanz & Herzog, 2005) that three broad types of factors put students at greater risk of dropping out of school:

- *Social background:* research clearly shows that students who have certain characteristics – including being from low-income, single-parent, and less-educated families, and taking on adult responsibilities such as becoming a parent and needing to work - are more likely to drop out.
- *Students' educational experiences:*
    - o Academic performance: students who fall behind academically, as shown by low grades and test scores, and by being retained at grade level, exhibit substantially higher dropout rates
    - o Engagement in school: students with high rates of absenteeism and poor behavior, and lower rates of participation in school activities, have been shown to exhibit higher rates of dropout
- *School characteristics:* various combinations of factors including perceptions of school climate and teacher support, school size, and rigorous curricula with high expectations have been shown to exert a substantial influence on dropout rates.

With respect to using the social background factors of individual students as predictors of dropout likelihood, Jerald (2006) notes that until quite recently, these were the primary criteria used to identify students at the greatest risk of dropping out. More in-depth research revealed at least three major problems with this approach, however. A first is that it was never clear how many, and which combinations, of risk factors needed to be present in order to place a student at high risk of dropping out, nor at which ages the various combinations of risk factors held the greatest predictive power. As just one example, while more instances of mobility (e.g., school changes) across a student's entire educational career might be associated with increased dropout probability, at least one study (Swanson & Schneider, 1999) found that *mobility during the early part of high school* can actually be beneficial, to a point, in terms of reducing dropout likelihood, in that leaving a high school in which a student was not having a good experience was preferable to remaining there. A second problem is that focusing on social background, or "status" (e.g., unchangeable) indicators as determinants of dropout likelihood left schools with little that was "actionable" on their part: what could a school do, after all, to change the fact that a student was from a low-income or single-parent family?

A third problem that became evident from the research is that focusing on background/status indicators deflected attention in many cases from other categories of risk factors noted above, which have ultimately proved to be much more important, or "high yield," indicators. In other words, it is not so much the case that being from a low-income or single-parent family per se causes a student to be at risk of dropping out, but rather his/her *lack of academic progress, and/or lack of engagement in school,* that produces this outcome. The two tend to be highly correlated, of course, but the point is that focusing on the factors that are actionable on the part of schools (e.g., whether students are progressing academically, and whether they view school as important and welcoming) is more accurate, in that it allows schools to most effectively and efficiently direct resources toward students who display "real" and accurate warning signs rather than targeting students who fit a certain "profile" or "checklist" of presumed risk categories, but are not in fact at elevated risk of dropping out because their academic progress is sufficient. Accordingly, the previously-accepted method of targeting prospective dropouts based on "checklists" of social and demographic risk factors was shown to be inefficient, because this approach not only targeted scarce resources toward students who in many cases did not wind up dropping out (e.g., the "Type 2" error, or the "false positive" problem), but also because it wound up missing many students who did drop out (Gleason & Dynarski, 2002).

With this background in mind, recent efforts to develop early warning systems have focused primarily on "mining" data sets for student-level information that points to elevated risk of adverse outcomes such as dropping out. Work conducted in Chicago and Philadelphia provides useful and well-documented examples here. In Chicago, the Consortium on Chicago School Research (CCSR) has conducted extensive work identifying risk factors that correlate strongly with graduation among students in the Chicago Public Schools (CPS), and arrived at four non-status measures: attendance, GPA, credit attainment, and failing grades (Allensworth & Eason, 2005). In particular, the combination of the latter two elements into an "on track" indicator for CPS 9th graders proved to be highly predictive of graduation, as more than 80% of students who are on-track wind at the end of grade 9 wind up graduating, compared to only 20% graduation probability for those who are off-track at the end of 9th grade. More detailed discussion of the on-track indicator developed in CPS, along with an adaptation for use in Milwaukee that we have called "Total Quality Credits," appears in the methodology section of this paper. In Philadelphia, University of Pennsylvania and Johns Hopkins University researchers similarly found a student's first year of high school to be a "make or break" year that was highly predictive of graduation probability, but also delved into students' middle school records to find that grades (including GPA and course failures, most notably) and attendance were highly correlated with the probability of graduating (Balfanz & Herzog, 2005).

Emerging from work in Philadelphia, Chicago, and other districts, therefore, was a growing consensus that early warning systems for identifying students at high risk of dropping out should focus on two main areas of data that are readily available in most cases: *academic achievement* (including grades obtained in core courses, course failures, and retention) and student engagement (primarily attendance and suspension data). Interestingly, and perhaps somewhat surprisingly, work in both districts found that while these middle school indicators served as important predictors of graduation probability, standardized test scores from middle school were, in general, not nearly as useful as predictors of adverse outcomes in high school. On the one hand, Chicago students with high 8th grade test scores were indeed more likely to be "on track" for graduation at the end of 9th grade, but it was also the case that many students with high test scores in middle school experienced significant difficulties after starting high school, while (vice versa) many students with comparatively low middle school test scores did fine as 9th graders. This same finding, as will be seen, emerges from our work in MPS. One explanation offered by Balfanz and Herzog (2005) for this apparent contradiction is that high schools themselves play a substantial role in determining whether, and which, students stay on track, and that unfortunately the transition to 9th grade acts like "a kind of quicksand" for many students, in that risk factors not observed prior to high school suddenly manifest themselves upon entry into 9th grade.

Having identified from prior research a set of "high yield" indicators upon which to base the initial phase of building an early warning system, a key, related question raised in the Philadelphia and Chicago work involves *how far back in a student's educational history* researchers should go in developing the most precise early warning indicators. Despite claims occasionally seen in research and commentary, there appears to be little thus far in terms of rigorous, compelling research to suggest that it is possible to identify, with a high degree of accuracy, students who are most at risk of failing to graduate based on outcomes as early as third grade. Instead, there appears to be some consensus emerging from early warning work (see Roderick, 1993; Roderick & Camburn, 1999; Roderick, Allensworth, & Nagaoka, 2004; Kennelly & Monrad, 2007) that the beginning of middle school is the optimal "starting point" for establishing the most accurate and precise early warning models. While in some cases it may be useful to incorporate pre-middle school data (e.g., from the elementary grades K-5), Roderick (1993) and others report that for many students, the patterns which ultimately predict dropouts with the highest degree of precision have not been sufficiently developed prior to middle school. Nearly two-thirds of eventual dropouts in Roderick's Massachusetts study, for example, had 4th grade attendance and grade patterns that were not appreciably different from students who wound up graduating in the bottom third of their class.

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In addition, using outcome data from elementary school may is thought to be somewhat premature in the sense that key "transitions" (e.g., from elementary to middle school, and from middle to high school) that are hugely significant in students' decisions to drop out have not yet occurred. Finally, it is typically the case that rich sets of outcome data are much harder to obtain for elementary (and to a lesser extent, middle school) students than is generally the case for high school students. While many student information systems store attendance and test score information for elementary students, for example, it is less common to have final grades and other useful input measures such as behavioral incidents for younger students, particularly as one goes further back in time. This was certainly the case with our early warning work in MPS, as the question of how far back in time to go essentially resolved itself in the sense that very limited outcome data from elementary grades was maintained in a reliable and consistent manner prior to 2005. The good news here, of course, is that prior research indicates that this is likely not a significant limitation, in that focusing on outcomes from middle school onward produces the most useful results.

No early warning system, of course, can possibly identify 100% of students who eventually drop out, or graduate with low levels of college readiness, since a host of school-specific and student-specific factors (some of which can't be readily tracked using data that schools typically collect and have access to) are known to influence dropout decisions. The Consortium on Chicago School Research, for example, has consistently found substantial differences across Chicago high schools – even those that are very similar in terms of size, student demographics, and other characteristics - with respect to having a "culture" that supports students' sense of engagement and connection with their school. Accordingly, the Consortium has greatly increased efforts to measure school culture through surveys and focus groups with students. As noted later, this represents an important direction for future research on early warning systems in MPS, as the data available in the development of this first early warning system was not nearly as comprehensive as those available in other districts. For example, a research consortium in Philadelphia has populated a database called the Kids Integrated Data System (KIDS) with not just school-based variables (student demographics, grades, attendance, test scores, etc.), but also a host of non-school variables related to students' lives and histories, such as parental income and educational attainment, social services data (incidents in which child protective services incidences), and health-related indicators such as exposure to lead paint. Research in Philadelphia using the KIDS database has shown that some of these non-school indicators, in fact, have even greater predictive power in terms of identifying future dropouts than do school-based indicators (Rouse & Fantuzzo, 2009). While comparable data-sharing agreements are not yet in place in Milwaukee, the point here is to emphasize that the early warning work in MPS summarized in this paper represents only a first step in what is hopefully a much longer-term effort to incorporate much richer data sets for identifying students at risk of adverse outcomes.

Very recently, and following the pioneering early warning work in Chicago and Philadelphia, a number of studies (see, for example, Williams, Kirst, Haertel, et al. [2010], Kurlaender, Reardon, et al. [2008] and Zau & Betts [2008]) have corroborated earlier findings which showed that many students at the greatest risk of failure in high school could in many cases be identified based upon combinations of middle school outcomes that generally include grades, attendance, behavior, and test scores. This research further demonstrated that success in the middle grades is a strong predictor of success in high school and beyond, including high school grades and credit attainment, scores on high school exams (of both an NCLB and end-of-course variety), and probability of enrolling in college. At the same time, however, each of these studies also corroborated, to varying degrees, the finding from Chicago and Philadelphia research that even the best sets of middle school data had limitations in the extent to which they were able to accurately identify future dropouts. In other words, the troubling conclusion remains that a very unfortunately, dismal process sets in when many students enter high school, culminating in these students eventually dropping out, that is not generally revealed by even the richest sets of middle school outcome data.

Finally, while early warning systems developed to date have, quite appropriately, focused on identifying students at risk for not completing high school, it became clear early on in the Senior Urban Fellowship work that a parallel area of concern was equally important. This involves students whose academic performance and level of engagement in school make them reasonably likely to graduate, but with very little evidence of having *skills that signify readiness for college and the workforce.* As such, the early warning system as developed for use in MPS very much has a dual purpose: to identify students at risk of dropping out, but also to identify and intervene on behalf of students for whom graduation is a reasonably likely outcome, but prospects for college and workforce participation and success are much less positive.

There is ample evidence that including a focus on college and workforce readiness, in addition to graduation probability, is a worthwhile goal for an early warning system. On a national level, as seen above, some good news clearly exists in that there has been slow, steady improvement in the percentage of young Americans (ages 18-24) who hold high school equivalency credentials. At the same time, however, there is concern that the *rigor* of many students' high school experiences may have been sacrificed in the process. Data from the NAEP High School Transcript Study (HSTS), for example, show that graduates from the class of 2005 completed more credits in high school (nearly three more, in fact), and earned higher grades (approximately one-third of a letter grade) compared with their counterparts from the class of 1990 (Shettle et al., 2007). It is also true that the percentage of U.S. high school graduates who attend college immediately after graduating has increased steadily over the past three decades, to the point where two-thirds of graduates now enroll in college right after they finish high school (Knapp, Kelly-Reid, & Ginder, 2010).

At the same time, however, the scale score performance of 12th graders nationwide on NAEP reading assessments has actually *declined* somewhat over the past two decades,[7] and the percentage of students who attain "college ready" scores on ACT subject tests[8] has remained virtually unchanged over at least the past five years. While two-thirds of 2008 high school graduates nationwide who took the ACT and went on to college reached the college readiness benchmark for English (whose corresponding college-level course is freshman-level English Composition), this is virtually identical to the level attained by 2004 graduates. Only 53% of 2008 graduates reached the college readiness benchmark for Reading (predicting readiness for freshman-level Social Science), 43% reached the Math benchmark score (predicting readiness for college Algebra), and 28% reached the Science benchmark (predicting readiness for college Biology). In all instances, the percentage of 2008 graduates who attained ACT college readiness benchmarks was virtually unchanged from 2004 (ACT, 2009).

In addition to the national-level data noted above, multiple sources of MPS-specific data validate the inclusion of college and workforce readiness indicators in an early warning system. While the percentage of MPS graduates who have completed rigorous coursework (defined as four years of English and three years each of math, science, and social studies) has increased from 38% for 2007-08 graduates to 48% for 2008-09 graduates, for example, both figures fell below goals set forth in the district's strategic plan, and there has been no corresponding increase in either 10th grade WKCE performance nor ACT composite scores to serve as an external validation of this apparent increase in course-taking rigor at the high school level. ACT subject-area sub-scores show, furthermore, that very few MPS students obtain scores that signify college readiness. Among MPS 11th graders

7 The mean national NAEP reading score for 12th graders in 2005 was 286, which is down from 292 in 1992. Since testing accommodations were not allowed for the 1992 administration, but were allowed in 2005, perhaps a better comparison is between 1998 results (mean scale score = 290) and 2005 (mean scale score = 286). NAEP mathematics performance data for 12th graders in 2005, the most recent year of administration for this age group, are not comparable to prior years due to a re-scaling of the 12th grade math test.

8 College readiness benchmark scores as defined by ACT research are the thresholds on ACT subscores in Reading, English, math, and science that are associated with at least a 50% probability of obtaining a grade of B or better, or a 75% probability of obtaining a C or better, in corresponding freshman-level college courses.

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who took the ACT in 2009, for example, only 3% had scores that met all four ACT benchmark scores, and only 6% and 4% had ACT Science and ACT Math scores that met college readiness benchmarks, respectively.[9] Data reported in the MPS Strategic Plan, additionally, indicate that nearly three-fourths (72.7%) of MPS 2008-09 graduates who went on to attend the University of Wisconsin-Milwaukee required remedial coursework as college freshmen, while 23.0% of MPS graduates who attend Milwaukee Area Technical College are placed into Basic Skills programs, rather than the more desired placement in occupational programs. As a final example, and as discussed in more detail in the next chapter, MPS high schools produce each year a large number of graduates with extremely low grade-point averages (e.g., around or below 1.0), which makes it very difficult to either continue their education at the college level or participate meaningfully in the workforce.

9 ACT college readiness benchmark scores are the minimum scores, validated by ACT research, needed on ACT subject-area tests (English, Math, Reading, and Science) to indicate a 50% chance of obtaining a B or higher or a 75% chance of obtaining a C or higher in the corresponding credit-bearing college course.

METHODOLOGY

PART 1. OVERVIEW OF DATA USED AND CHALLENGES ENCOUNTERED

This section describes the sources and availability of data that have been used in building the early warning system in MPS, along with challenges encountered during this process. Given the importance of the first year of high school in terms of predicting eventual graduation/dropout outcomes, as established through research in Chicago and Philadelphia, it makes sense in terms of naming and labeling conventions to use this year (first time grade 9 enrollment) as the "starting point" in an early warning system, and to work backward (e.g., into middle school) and forward (into high school) from there.

At the onset of the early warning work in MPS, therefore, the goal in terms of assembling data sets was to build a comprehensive "master file" containing all relevant data to encompass the educational experiences of several cohorts of MPS students starting with first-time 9th grade enrollment. Since an obvious goal of an early warning system is to identify students at elevated risk of adverse outcomes as soon as possible – but not too soon so as to be misleading – the research noted previously from Chicago and Philadelphia suggested that middle school (e.g., the beginning of grade 6) represented a suitable "starting point" for describing the educational experiences of first-time 9th graders. As far as the "ending point" for each cohort of first-time 9th graders, an obvious choice is the high school "final outcome" (e.g., graduation or dropping out), although even more desirable would be data documenting post-high school outcomes such as initial college enrollment and graduation, along with wage data.

Upon further consideration, assembling a data set to describe the full educational experience of first-time 9th graders turns out to be a rather ambitious goal, as it requires at least 9 years of panel data for the same cohort to accurately describe just the middle and high school portion of these students' educational experiences, as follows:

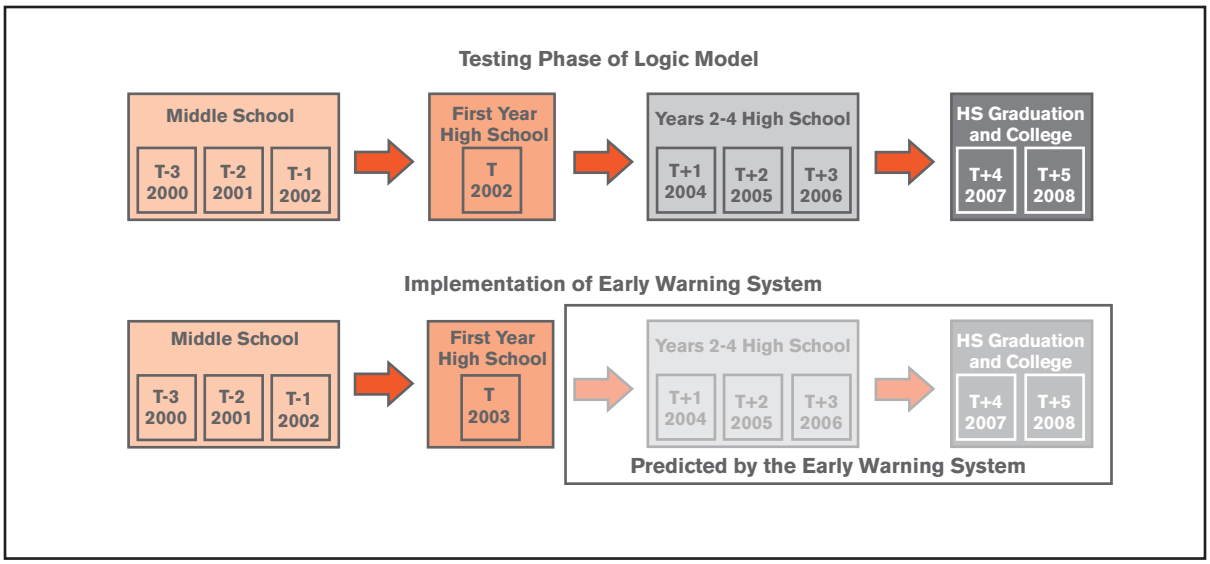
- Four years to capture the full middle school experience, from entry as first-time 6th graders (three years of schooling, plus at least one additional year to capture one instance of retention during the middle grades)
- Six years to capture the full high school experience, from entry as first-time 9th graders (four years of schooling in high school, plus two additional years to capture two instances of retention during grades 9-12.[10]

The reality of the available data in MPS fell somewhat short of this ideal data scenario. To begin with, complete *middle school* data sets (containing students' final grades and courses taken, test scores, monthly attendance rates, behavioral incidents, etc.) were available only from the 2000-01 school year onward, for example, which meant that final high school outcomes (graduation vs. dropout) could not be verified for first-time 6th graders in 2000-01 until 2010-11 at the earliest. In other words, under the complete, 9-year panel data model, we are effectively limited to looking at middle school outcomes for students who were first-time 9th graders *no earlier* than 2004-05, since these students would have been 6th graders in 2001-02 (assuming they didn't repeat any grades during middle school). First-time 9th graders in 2004-05 (and 2005-06, recalling that multiple cohorts are preferable for generalizability), however, would not graduate under a full, six-year portrait of high school[11] until 2009-10 and 2010-11, respectively.

10 The annual MPS retention rate for grade 9 alone is approximately 25-30%.

11 According to a 2008 MPS study of high school completion patterns, six years is necessary to most accurately determine whether students graduate or drop out as their final outcome, due to high rates of retention in MPS at the high school level, particularly in grade 9.

FIGURE 1: TOTAL QUALITY CREDIT (TQC) ATTAINMENT LOGIC MODEL WITHIN EARLY WARNING SYSTEM



A related problem was that MPS's eSIS system, which is the district's student-level transactional data system documenting student enrollment, course-taking histories, and other data elements necessary for building an early warning system was not implemented in the middle grades until the 2005-06 school year.

A final issue was that MPS operated two separate data warehouses for a time during the transition to a new system which became operational in 2006-07. Certain data elements were supplied to both the new and old systems for several years, but others – including some aspects of course-taking histories and final marks – were available for some years in either the old or new system, but not for all years in both systems.

In balancing the data *needs* of an effective early warning system with the availability of MPS data required for this purpose, therefore, it was obvious at an early phase of work that a "workaround" solution was necessary. The solution, broadly stated, was to employ a two-stage recursive data modeling structure[12] that provides a "complete" data set by linking together necessary elements from disparate sources.

More specifically, the recursive structure used in our work combines necessary data elements for the middle school portion of students' educational experience from two distinct cohorts of students (first-time 9th graders in 2005-06 and 2006-07) with different data sets describing the *high school* portion of the educational experience (from two different cohorts of first-time 9th graders, in 2001-02 and 2002-03). These two data sets are linked together through an outcome measure developed for this project that we have entitled "Total Quality Credits" (TQC) during the first year of high school, which is a construct (described more fully later on in this chapter) that combines credit attainment and final grades to create a very useful measure of academic progress. In other words, what the two-stage recursive model does is to predict end of high school outcomes (graduation and initial college enrollment) using TQC attainment during the first year of high school, which is itself predicted by a full set of outcome data (grades, attendance, test scores, etc.) from middle school. This process is depicted in Figure 1 above.

12 See Gruenewald et al, 2008

PART 1. OVERVIEW OF DATA USED AND CHALLENGES ENCOUNTERED

The first step in the recursive data modeling process is to determine which students are first-time 9th graders, which is considered year *t*. This was done using third Friday enrollment counts for each year, with a student considered to have initial grade 9 enrollment in a given year if they are in grade 9 that year, but not in grade 9 the prior year (either because they are new to MPS for grade 9 in year t or, in most cases, because they were in grade 8 the prior year). The importance of using chronological year in school (e.g., year t, t-1, t+1, etc.), rather than grade, as the "yardstick" for measuring student progress due to the fact that the MPS retention rate for grade 9 has been in the 25-30% range in recent years. Under this logic, the naming structure for each year is thus as follows:

- Year t+5: sixth year of high school
- Year t+4: fifth year of high school
- Year t+3: fourth year of high school (grade 12 under normal grade progression)
- Year t+2: third year of high school (grade 11 under normal grade progression)
- Year t+1: second year of high school (grade 10 under normal grade progression)
- Year t: first year of grade 9
- Year t-1: grade 8
- Year t-2 (grade 7 under normal grade progression)
- Year t-3 (grade 6 under normal grade progression)

To summarize the data modeling structure, our strategy for developing the early warning system for MPS has been to incorporate two distinct sets of data:

- Identifying risk factors based on ***students' experiences during the first year of high school and beyond,*** using known dropouts and graduates[13] from two cohorts of first-time MPS 9th graders (2001-02 and 2002-03);
- Identifying a complementary set of risk factors based on ***students' experiences during middle school,*** using data from two separate cohorts of first-time MPS 9th graders (2005-06 and 2006-07).

While having a full, 9+year set of panel data for the same cohort of students is perhaps a "cleaner" approach toward building an early warning system, it turns out that using the two-pronged data approach described above (e.g., splicing together high school outcomes using first-time 9th graders in 2001-02 and 2002-03 with middle school outcomes using first-time 9th graders in 2004-05 and 2005-06) does offer at least one major advantage: much more current data can be used. In other words, using the full panel of data for the same cohorts of students essentially supports conclusions about middle school risk factors that is somewhat "old" data by the time findings can be generated. That is, just because middle school risk factors from 2003-04 were good predictors of graduation does not necessarily mean that the same set of middle school risk factors from 2007-08 were equally good predictors of graduation, as the "landscape" of middle school might have changed in important ways (e.g., a revamping of the middle school reading curriculum or disciplinary policies, moving from traditional middle schools to K-8 arrangements, etc.).

13 The process for determining which students are "confirmed" dropouts involves a set of codes used in the MPS electronic student information system (ESIS) to ensure that a student is only enrolled in one school at a time. When a student leaves a school, a code is entered to describe his/her reason for leaving and next destination, if known (e.g., graduated, left for another school within MPS, left for another district in Wisconsin, left to go out of state, incarcerated, deceased, etc.). In the end, a student is counted as a dropout if they have one of three codes that represent what is "left over" after all other possible outcomes have been accounted for. Due to the fact that a considerable number of MPS students who wind up graduating take more than four years to do so, "graduates" are considered to be any students from the cohorts of first-time 9th graders in 2001-02 and 2002-03 that graduated within six years.

PART 2. DATA INVENTORY: WHAT IS KNOWN ABOUT MPS DROPOUTS?

A logical next step in building an early warning system is to assemble descriptive data on potential "high yield" indicators identified in prior research as being predictive of adverse outcomes such as dropping out and graduating with low levels of college/workforce readiness. The following section summarizes key descriptive findings related to known dropouts from two cohorts of first-time MPS 9th grade students (in 2001-02 and 2002-03), based upon a longitudinal cohort study conducted by the MPS Division of Research and Assessment.

- *How early into their high school career do most MPS students tend to drop out?*

A key piece of information underlying the development of an early warning system is to get a sense of when students in MPS tend to drop out most often, both in terms of how many years into high school as well as students' last grade level prior to dropping out.

Table 1 shows dropout frequency data by both length of time after first-time grade 9 enrollment and by last known grade of enrollment among first-time MPS 9th graders in 2001-02 and 2002-03. The information used to determine when a student drops out comes from "withdrawal codes" taken from the district's ESIS database, as described in Footnote 13. It is acknowledged here that using dates associated with ESIS withdrawal codes likely has some degree of imprecision in terms of accurately capturing the specific date that a student quit coming to school long enough to be classified as a dropout, but this remains the best source of information that can be used for this purpose.

An initial observation is that a relatively small number of MPS students who wound up as dropouts (7.1% across the two cohorts combined) did so during their first year of high school. This figure closely matches the 5% of

TABLE 1: DROPOUT FREQUENCY FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03 BY LENGTH OF TIME (IN YEARS) AFTER INITIAL 9TH GRADE ENROLLMENT AND LAST GRADE

	NUMBER AND % OF DROPOUTS BY COHORT OF FIRST-TIME 9TH GRADERS:		
	2001-02	2002-03	2-YEAR TOTAL
Dropout Frequency by Length of Time after Initial 9th Grade Enrollment:			
During 1st year of high school (year t)	69 (5.7%)	111 (8.3%)	180 (7.1%)
During 2nd year of high school (year t+1)	200 (16.4%)	172 (12.9%)	372 (14.6%)
During 3rd year of high school (year t+2)	254 (20.9%)	313 (23.5%)	567 (22.3%)
During 4th year of high school (year t+3)	357 (29.3%)	391 (29.4%)	748 (29.4%)
During 5th year of high school (year t+4)	237 (19.5%)	247 (18.6%)	484 (19.0%)
During 6th year of high school (year t+5)	74 (6.1%)	96 (7.2%)	170 (6.7%)
Total Dropouts	1218 (100.0%)	1330 (100.0%)	2548 (100.0%)
Dropout Frequency by Last Grade of Enrollment:			
9	264 (21.7%)	398 (29.9%)	662 (26.0%)
10	289 (23.7%)	345 (25.9%)	634 (24.9%)
11	292 (24.0%)	330 (24.8%)	622 (24.4%)
12	149 (12.2%)	169 (12.7%)	318 (12.5%)
Other grades/missing data[14]	224 (18.4%)	88 (6.6%)	312 (12.2%)
Total dropouts	1218 (100.0%)	1330 (100.0%)	2548 (100.0%)

14 In some cases, there is no last grade recorded for students who have one of the three exit codes used to denote dropouts, while in another (very small) number of cases, the last recorded grade represents an obvious data entry error (e.g., grade 3). A third group of cases has a last grade of 8; this may represent students who reached the age of 18 (the earliest age at which a student can legally drop out in Wisconsin under current state law), but were still in 8th grade at the time they dropped out due to multiple instances of repeating a grade. This third group of students is included in the analysis of when "first-time 9th graders" in 2002-03 dropped out, even though they never actually reached grade 9, because it is important to get the most accurate picture of when students drop out.

PART 2. DATA INVENTORY: WHAT IS KNOWN ABOUT MPS DROPOUTS?

students who drop out of Philadelphia high schools during their first year of high school (Neild & Farley, 2004). It is more common for MPS students, as was true for their peers in Philadelphia, to drop out during their third and fourth years of high school, although a surprising number of MPS students make it to their fifth and even sixth[15] year of high school before dropping out. This observation is corroborated by the fact that MPS dropout rates by grade show that the highest "event" dropout rate for any of the high school grades in 2008-09 was at grade 11 (10.4%); traditionally, the highest dropout rates in the district had been observed for 9th graders, but in 2008-09 the grade 9 dropout rate of 9.6% was eclipsed by 11th graders.

As has been observed in other cities, therefore, it appears that dropping out of MPS as an outcome is best understood as a gradual process of disengagement and academic shortcoming that often plays out across multiple years of a student's high school career, rather than as a single catastrophic event that leads to immediate withdrawal from school.

Despite the fact that many MPS students persist into their fourth, fifth, and even sixth year of high school before dropping out, however, the largest group of dropouts in terms of students' last grade prior to dropping out was 9th graders, who were 26.0% of all dropouts for the two cohorts combined. This indicates that many students are retained in 9th grade once, and even twice in a substantial number of cases, before dropping out. This confirms, as noted previously, the need to treat grade in high school as a completely different variable than *amount of time spent* in high school, since so many MPS students do not make the "typical" progression (e.g., being promoted from grade 9 after their first year of high school to grade 10, then to grade 11 at the end of their second year, etc.).

The data also show that quite a few students "linger" for some time in MPS high schools – into their fifth and even sixth[15] years – and progress credit-wise to the point of attaining junior and even senior status before dropping out. This finding is consistent with research conducted by Roderick (1993), who identified two distinct groups of dropouts: an "early" group that left school between the 7th and 9th grades, and a "later" group that left between the 10th and 12th grades.

- *How do eventual dropouts and graduates differ with respect to key outcome indicators during the first year of high school and middle school years?*

The first year of a student's high school experience is widely recognized, based on prior research (Allensworth & Easton, 2005; Balfanz & Herzog, 2005; Jerald, 2006), as a critical determinant of whether s/he ultimately graduates or drops out. Accordingly, presented below are a set of tables that differentiate graduates from dropouts among first-time MPS 9th graders in 2001-02 and 2002-03 with respect to the following indicators:

- GPA (unweighted)[16] and passing rates in core subjects (math, reading, science, and social studies)
- Grade 9 retention rates
- Absenteeism
- Behavioral incidents (suspensions)
- Grade 8 test scores
- Student mobility

15 Most of the students who are in their sixth year of high school enrollment are students with disabilities; the Individuals with Disabilities Education Act (IDEA) stipulates that school districts are required to provide services to students with disabilities up to the age of 21.

16 Unweighted GPA is used for analysis purposes here (A=4.0, B=3.0, C=2.0, D=1.0) because MPS students' access to Advanced Placement courses is quite uneven across high schools; many sites offer few, if any, such courses.

GPA

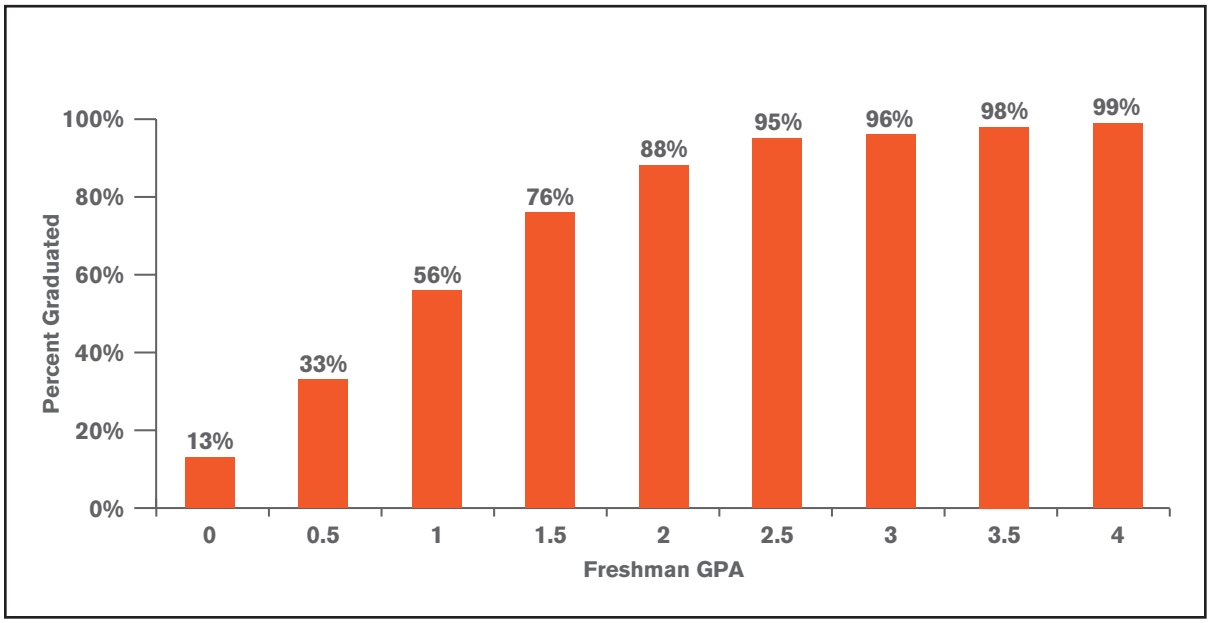
Starting with mean GPA in the four "core" academic subjects of reading, math, science, and social studies, it is not surprising to find that eventual dropouts had substantially lower first-year GPAs in the core subject areas of math, reading, science, and social studies courses than did eventual graduates. Note here that "graduates" include all students who graduated within six years of initial grade 9 enrollment, rather than just students who graduated on time; this decision was made given the high rates of grade 9 retention in MPS noted above, which preclude many MPS students who eventually do graduate from doing so on-time. As seen in Table 2, there is massive failure among eventual dropouts with respect to core academic courses. More than 90% of first-time 9th graders in the two cohorts combined who wound up dropping out (n=2548) had a mean GPA across their first-year high school math courses of 1.0 or lower, and fully 60% of math courses taken by eventual dropouts resulted in a failing grade. The performance of eventual dropouts in reading, science, and social studies was only marginally better, with mean GPA of 0.76 – 0.82 and failure rates of approximately 55%.

By contrast, students who eventually graduated (n=7452) had mean core-subject GPAs around 2.0, and passed about 85% of their courses.

Another, more visual depiction of the relationship between course outcomes and graduation probability is seen in Figure 2, which shows graduation rates by overall first-year GPA among first-time 9th graders in 2001-02 and 2002-03 combined. Importantly, there is relatively little decline in graduation probability from an A average (4.0 GPA) to approximately a C average (2.0), although the odds of graduating decrease markedly below a C/2.0.

The very low GPA and passing rates among eventual dropouts are even more discouraging when considering that numerous students drop out early enough during their first year of high school (e.g., before the end of fall semester) that they have not yet received any final marks. If all of these students had instead remained enrolled through the end of the fall semester, when they would have received their (presumably very low) semester grades, the mean GPA and passing rates among dropouts would likely be even lower.

FIGURE 2: GRADUATION RATE BY FIRST-YEAR OVERALL GPA FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)



PART 2. DATA INVENTORY: WHAT IS KNOWN ABOUT MPS DROPOUTS?

TABLE 2: COMPARISON OF FIRST-YEAR GPA IN CORE ACADEMIC SUBJECTS FOR KNOWN DROPOUTS AND GRADUATES AMONG FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03

	2001-02:		2002-03:		2-YEAR TOTAL (COMBINED):	
	DROPOUTS (N=1218)	GRADUATES (N=3762)	DROPOUTS (N=1330)	GRADUATES (N=3690)	DROPOUTS (N=2548)	GRADUATES (N=7452)
GPA in first-year Math courses:						
0.00-1.00	75.1%	28.3%	75.5%	29.0%	75.3%	28.6%
1.01-2.00	15.2%	27.8%	15.4%	28.7%	15.3%	28.3%
2.01-3.00	7.6%	25.2%	7.4%	23.3%	7.5%	24.2%
3.01-4.00	2.0%	18.7%	1.8%	19.0%	1.9%	18.9%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mean GPA for first-year math courses	0.74	2.04	0.76	2.03	0.75	2.04
Pass rate for first-year math courses	38.5%	84.1%	41.2%	84.7%	39.9%	84.4%
GPA in first-year Reading courses:						
0.00-1.00	74.7%	22.0%	70.8%	21.5%	72.6%	21.8%
1.01-2.00	16.8%	30.5%	19.9%	29.9%	18.5%	30.2%
2.01-3.00	6.8%	29.8%	7.3%	30.0%	7.0%	29.8%
3.01-4.00	1.8%	17.6%	2.0%	18.8%	1.9%	18.2%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mean GPA for first-year reading courses	0.75	2.15	0.85	2.19	0.81	2.17
Pass rate for first-year reading courses	41.3%	88.6%	47.3%	89.5%	44.4%	89.0%
GPA in first-year Science courses:						
0.00-1.00	77.1%	25.0%	72.4%	20.9%	74.6%	23.0%
1.01-2.00	14.4%	29.5%	19.0%	28.6%	16.8%	29.1%
2.01-3.00	6.8%	26.9%	5.2%	28.9%	5.9%	27.9%
3.01-4.00	1.8%	18.6%	3.4%	21.6%	2.6%	20.1%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mean GPA for first-year science courses	0.71	2.12	0.80	2.25	0.76	2.18
Pass rate for first-year science courses	39.8%	87.8%	44.4%	90.2%	42.2%	89.0%
GPA in first-year Social Studies courses:						
0.00-1.00	73.6%	24.0%	72.2%	20.9%	72.8%	22.4%
1.01-2.00	15.3%	27.9%	18.6%	29.1%	17.1%	28.5%
2.01-3.00	8.9%	28.2%	7.7%	29.9%	8.2%	29.0%
3.01-4.00	2.2%	19.9%	1.6%	20.1%	1.9%	20.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mean GPA for first-year Social Studies courses	0.79	2.16	0.84	2.22	0.82	2.19
Pass rate for first-year Social Studies courses	42.6%	87.4%	47.9%	89.4%	45.4%	88.4%

It is also quite interesting to note that a large number of graduates did rather poorly in core academic subjects despite eventually graduating. In math, for example, well over half (56%) of eventual graduates had a GPA of 2.0 or less in their math courses, including 28% with a 1.0 or less (equivalent to a D average). With a two-year combined total of nearly 7500 graduates, this is more than 2100 students in just these two cohorts alone; in other words, MPS annually graduates more than 1000 students whose mean math GPA is a D average or worse. The picture is again only marginally better in the three other core subjects, with large numbers of students earning diplomas despite very meager records of achievement. One clear policy implication from this finding is that simply focusing on whether students are "on track" to graduate, in terms of attaining enough credits to be promoted from year to year, should not be considered a sufficient goal for an early warning system. Given the importance of GPA as a determinant of other key outcomes after high school – most notably, the probability of enrolling in college –a focus on college/workforce readiness is an equally important, and necessary, component of an early warning system.

Retention Rates

Moving next to a contrast between the *grade 9 retention rates* of dropouts vs. graduates, Table 3 shows, again not surprisingly, that more than half of first-time MPS 9th graders in 2001-02 and 2002-03 combined who dropped out had been retained either once (33.4%) or more than once (an additional 23.1%) as 9th graders, compared to just 9.8% and 1.2% of those who eventually graduated, respectively. The mean number of grade 9 retentions among eventual dropouts, accordingly, was nearly five times higher than the mean number of retentions for eventual graduates (0.57 vs. 0.11, respectively). Viewing the same data a bit differently, however, produces the somewhat surprising, and important, finding that some 44% of MPS students who eventually dropped out had not been retained in grade 9 - and thus would have been considered "on track" for graduation if the only outcome being tracked was credit attainment.[17]

Absenteeism

With respect to *absenteeism* during the first year of high school, the data shown in Table 4 paint a somewhat more complex picture. At first glance, there appears (not surprisingly) to be a strong relationship between absenteeism and dropout likelihood. Students who eventually dropped out from the 2001-02 and 2002-03 cohorts combined had a mean absence rate during their first year of high school (36.3%) that was nearly

TABLE 3: COMPARISON OF GRADE 9 RETENTION RATES BETWEEN DROPOUTS AND GRADUATES AMONG FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03

	2001-02:		2002-03:		2-YEAR COMBINED:	
	DROPOUTS (N=1218)	GRADUATES (N=3762)	DROPOUTS (N=1330)	GRADUATES (N=3690)	DROPOUTS (N=2548)	GRADUATES (N=7452)
Retention in Grade 9:						
Retained in grade 9:						
Retained once	33.2%	10.6%	33.5%	8.9%	33.4%	9.8%
Retained more than once	23.0%	1.5%	23.2%	0.9%	23.1%	1.2%
Not retained	43.7%	87.9%	43.3%	90.2%	**43.5%**	**89.0%**
	100.0%	100.0%	100.0%	100.0%	**100%**	**100%**
Mean # grade 9 retentions	0.56	0.12	0.57	0.10	**0.57**	**0.11**

17 In the Chicago Public Schools (CPS) an "on-track" measure is commonly reported to track student progress at the end of the first year of high school. Students are considered to be on-track at the end of their first year of high school if they meet two conditions: attaining at least five credits during the first year of high school and not receiving more than one semester F in core academic subjects during their first year of high school.

PART 2. DATA INVENTORY: WHAT IS KNOWN ABOUT MPS DROPOUTS?

TABLE 4: COMPARISON OF FIRST-YEAR ABSENCE RATES BETWEEN DROPOUTS AND GRADUATES AMONG FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03

	2001-02:		2002-03:		2-YEAR COMBINED:	
	DROPOUTS (N=1218)	GRADUATES (N=3762)	DROPOUTS (N=1330)	GRADUATES (N=3690)	DROPOUTS (N=2548)	GRADUATES (N=7452)
First-Year Absence rate:						
10% or less	17.2%	67.6%	18.2%	69.4%	17.7%	68.5%
10.1% - 20%	15.7%	18.2%	18.4%	19.0%	17.1%	18.6%
20.1% - 30%	14.5%	7.0%	15.5%	6.5%	15.0%	6.7%
30.1% - 40%	12.0%	3.8%	12.1%	2.4%	12.0%	3.1%
40.1% - 50%	9.1%	1.6%	8.9%	1.2%	9.0%	1.4%
50.1% - 60%	7.8%	0.8%	7.9%	0.8%	7.8%	0.8%
60.1% - 70%	6.3%	0.5%	6.3%	0.4%	6.3%	0.4%
70.1% - 80%	7.7%	0.2%	4.7%	0.1%	6.1%	0.2%
80.1% - 90%	5.8%	0.2%	5.5%	0.1%	5.7%	0.2%
90.1% - 100%	4.0%	0.1%	2.6%	0.1%	3.3%	0.1%
Total	100.0%	100.0%	100.0%	100.0%	100%	100.0%
Mean overall absence rate (9 months)[18]	39.8%	10.6%	34.6%	9.3%	36.3%	9.7%

four times higher than that of students who wound up graduating (9.7%), and very few students (approximately 6%) with high rates of first-year absence (defined here as 30% or higher) wound up graduating.

At the same time, however, a surprisingly high share of eventual dropouts – more than one-third, in fact (34.8%) - had comparatively low rates (20% or less) of first-year absenteeism. By comparison, the current year-to-date absence rate for all MPS 9th graders as of this writing in spring 2010 is 77.0%.[19] Clearly, missing even 10% of total days should be considered a high rate of absence, as it is the equivalent of missing one day every two weeks of school, but the point here is to call attention to the fact that while dropouts indeed have higher rates of absence than graduates, it is by no means the case that eventual dropouts are all characterized by excessive rates of absence. Instead, it might be said that good attendance during the first year of high school in MPS is a necessary, but not sufficient, condition for graduation.

A visual depiction of the relationship between graduation probability and first-year absence rates is shown in Figure 3; the relationship is mostly linear, as might be expected.

Several studies involving early warning work have made the case that all absences are not created equal, and that greater predictive power for negative outcomes such as failing to graduate might be provided by focusing on *unexcused* absences rather than *total* absences. In order to know how much distinction exists in MPS with respect to these two categories of absence, we reviewed data for several years, and found that unexcused absences represent 60-65% of total absences each year.[20] While it is indeed possible, therefore, to substitute unexcused absences for total absences in early warning analyses,

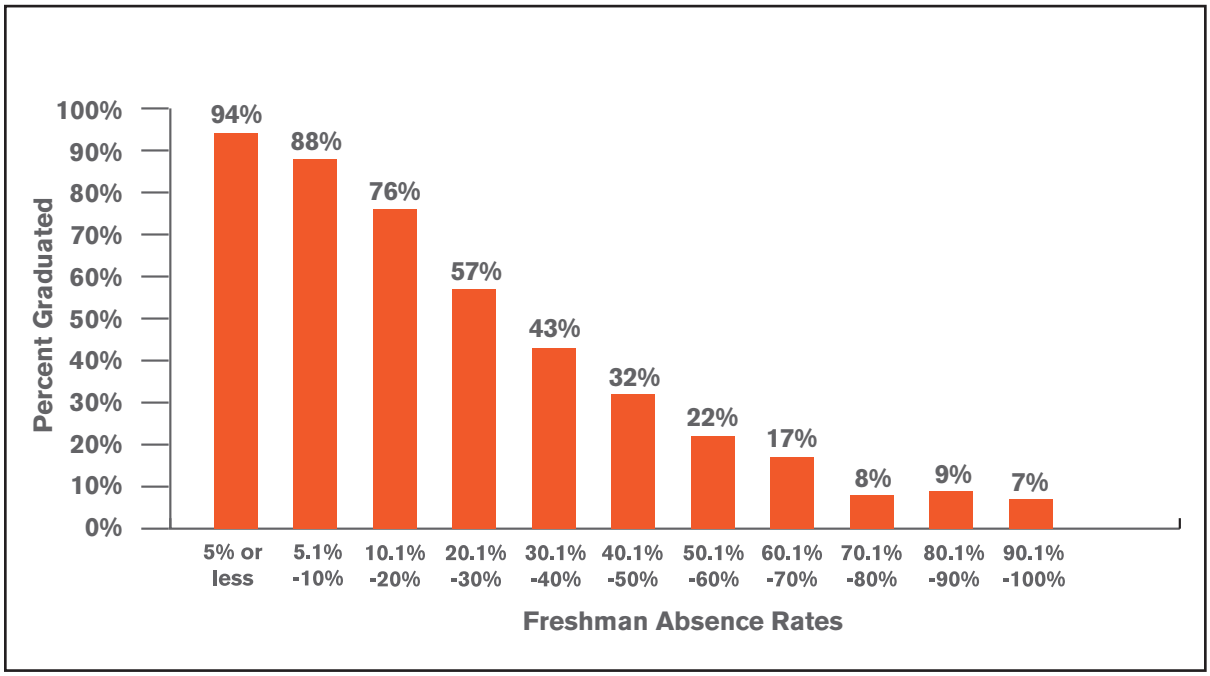
Percent Graduated

18 The overall absence rate shown is for the nine months of the traditional school calendar (September-May), in order to present the most accurate picture of monthly attendance by excluding months when few students are in session (June – August).

19 Figure drawn from the MPS data warehouse on May 3, 2010.

20 MPS absence data include four main categories: unexcused (no excuse provided by parent), non-excused (excuse provided by parent, but for a non-valid reason such as caring for siblings), excused (valid excuse provided, such as an illness or doctor appointment), and authorized (absence is due to a valid, school-based activity such as a field trip). For purposes of the early warning analysis summarized in this report, "unexcused absences" include the unexcused and non-excused categories, while "excused absences" include the excused and authorized categories.

FIGURE 3: GRADUATION RATE BY FIRST-YEAR ABSENCE RATE FOR MPS FIRST-TIME 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)



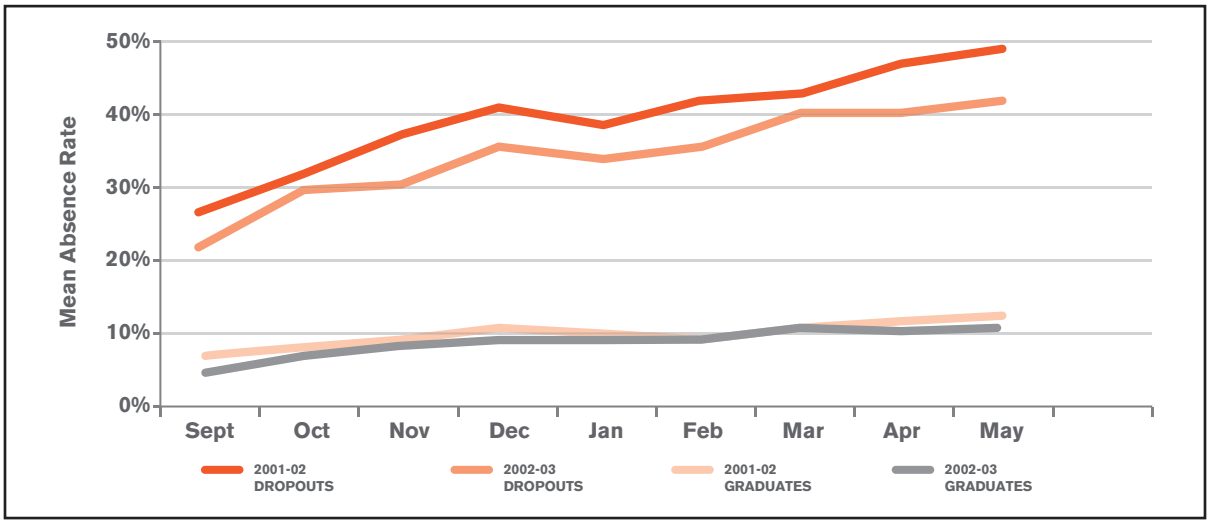
there is substantial overlap between the two categories, and it might further be argued that time out of the classroom represents lost learning time regardless of cause. It is also true, as described in results from regression analyses later, that absence rate is already a statistically significant predictor of graduation, and that "filtering" absence by excused/unexcused does not add to the overall efficacy of the early warning models in MPS.

In addition to separating absence data by type (excused vs. unexcused), another aspect of absenteeism as a predictor of graduation probability involves its distribution across the school year. For example, early warning research in Philadelphia (Balfanz & Herzog, 2005) revealed that high rates of absence within the first 30 days of the school year were particularly good predictors of which students wound up dropping out. They surmise that this is because the first month represents the crucial time immediately following the transition from middle to high school, which for most students involves a move from an elementary (K-8) or middle (6-8) school to a much larger and less personalized learning environment. Accordingly, their research recommended that Philadelphia high schools monitor 9th graders' attendance particularly closely during the first month of school.

In MPS, however, this scenario appears to be only partially true, as shown in Figure 4. Dropouts do have substantially higher rates of absences in each month, including September, than do graduates. At the same time, monthly absence rates among dropouts are actually at their lowest in September, before rising steadily through the remaining months of fall semester. Absence rates for dropouts then drop slightly in January at the start of spring semester, and then continue to rise until the end of the school year (May), when they are at their highest point of the year (in the 40-50% range - or missing, on average, *nearly half* of all possible days of attendance). As such, targeting attendance rates during September makes sense in that absenteeism is substantially higher during this month for eventual dropouts than for eventual graduates, but this is no more true in September than in other months.

PART 2. DATA INVENTORY: WHAT IS KNOWN ABOUT MPS DROPOUTS?

FIGURE 4: MEAN ABSENCE RATES DURING FIRST YEAR OF HIGH SCHOOL, BY MONTH, FOR DROPOUTS VS. GRADUATES IN THE COHORTS OF FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03



Behavioral Incidents

Research on dropout prevention suggests that *student behavioral data,* most often in the form of tracking suspensions, is also a worthwhile inclusion in early warning systems. Accordingly, our analysis queried student discipline data files to investigate the relationship between suspensions and probability of graduation. Since complete and reliable MPS disciplinary data are not available for the school year 2001-02, Table 5 shows results for first-time 9th graders for the school year 2002-03. Perhaps not surprisingly, eventual dropouts were more likely to have been suspended at least once than eventual graduates, and were especially prone to multiple instances of suspension (37.3% of eventual dropouts suspended more than once vs. 14.9% of eventual graduates). The mean number of suspensions incurred during the first year of high school, similarly, was notably higher for eventual dropouts (2.08) than for eventual graduates (0.70). In terms of the severity of the offenses which led to suspension, this can be measured reasonably well by the number of suspension days assigned, and the data confirm that suspensions incurred by eventual dropouts tend to be more severe than those incurred by eventual graduates. Just over half (54.0%) of suspension incidences incurred by eventual dropouts resulted in zero or one days of assigned suspension days, compared to 78.8% of those incurred by eventual graduates; conversely, the remaining share of suspensions (46.0% for eventual dropouts vs. 21.2% for eventual graduates) resulted in two or more suspension days assigned. The mean number of suspension days for eventual dropouts was also substantially higher than for eventual graduates (5.37 vs. 1.74, respectively).

Middle school standardized test scores

Middle school standardized test scores represent another indicator that is commonly considered for inclusion as a predictor in early warning systems. Table 6 shows the distribution of both dropouts and graduates among first-time MPS 9th graders in 2001-02 and 2002-03 combined in terms of grade 8 Wisconsin Knowledge and Concepts Examination (WKCE) reading and math proficiency levels as well as mean scale scores. Wisconsin's assessment system, unfortunately, has no test for 9th graders, which would be very useful as both a predictor of future success (e.g., high school graduation) and, perhaps more importantly, as a "missing link" between the currently-tested grades of 3-8 and 10. It would be possible, of course, to compare the 10th grade WKCE scores of eventual graduates and dropouts, but this probably makes little sense when considering that

TABLE 5: COMPARISON OF FIRST-YEAR SUSPENSION INCIDENCES FOR DROPOUTS AND GRADUATES AMONG FIRST-TIME MPS 9TH GRADERS IN 2002-03

	2002-03 FIRST-TIME 9TH GRADERS:	
	DROPOUTS (N=1330)	GRADUATES (N=3690)
Suspensions during first year of HS:		
Suspended once	14.7%	12.7%
Suspended more than once	37.3%	14.9%
Never Suspended	47.5%	72.4%
Total	100.0%	100.0%
Total days of suspension:		
0 days	47.5%	72.4%
1 day	6.5%	6.4%
2-5 days	16.5%	10.6%
6-20 days	11.9%	6.2%
1 month	15.3%	4.0%
1 semester	2.1%	0.4%
Entire school year	0.2%	0.0%
Total	100.0%	100.0%
Mean # of First-Year Suspensions	2.08	0.70
Mean total days of Suspension	5.37	1.74

many students who drop out do so while 9th graders, meaning that they aren't around to take the grade 10 test.

Table 6 shows that the mean grade 8 math scale score of eventual graduates from the combined cohorts of first-time MPS 9th graders in 2001-02 and 2002-03 (n=7452) was 674.9, which was more than 25 points higher than the mean score of dropouts (649.3; n=2548). The discrepancy between dropouts and graduates was nearly identical, at 24.5 points, in reading (670.6 for graduates vs. 646.1 for dropouts).[21] In terms of proficiency levels, however, very low rates of proficiency among MPS 8th graders, particularly in math, make this a much less useful basis for differentiating between eventual dropouts and graduates. If one was inclined to use proficiency (defined as scoring in either the proficient or advanced category) as a predictor of dropping out vs. graduating, for example, there is a clear difference between dropouts (of whom only 17.8% were proficient/advanced as 8th graders) and graduates (43.1% proficient + advanced). In math, however, proficiency rates were extremely low among both eventual graduates (10.6%) and eventual dropouts (2.3%), such that proficiency is not particularly helpful in distinguishing one group from the other.

Interestingly, the finding that middle school test scores are of somewhat limited value as predictors of dropout probability is also noted in early warning research in Chicago and Philadelphia. In Chicago, for example, it was true, on the one hand, that students who had high test scores as 8th graders were more likely to be "on track" for graduation than were their peers with lower scores. At the same time, however, high scores in grade 8 were no guarantee of being on track, nor did low grade 8 scores doom students to being off track. Among 2003-04 CPS first-time 9th graders, for example, fully one-fourth of students who entered high school in the highest quartile

21 Note that the WKCE scale changed beginning in 2005-06, so grade 8 scale scores described above (from 2000-01 and 2001-02, when first-time 9th graders used in this comparison would have been in grade 8) are substantially different from those reported for 8th graders since 2005-06.

PART 2. DATA INVENTORY: WHAT IS KNOWN ABOUT MPS DROPOUTS?

TABLE 6: GRADE 8 WKCE READING/MATH PROFICIENCY DISTRIBUTION AND MEAN SCALE SCORE FOR GRADUATES VS. DROPOUTS FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)

		GRADE 8 WKCE MATH:			GRADE 8 WKCE READING:		
		COUNT	% OF TOTAL	MEAN SCALE SCORE[22]	COUNT	% OF TOTAL	MEAN SCALE SCORE
Graduates:							
	Not Tested[23]	1389	18.6%	674.9	1387	18.6%	670.6
	Minimal	2815	37.8%		1656	22.2%	
	Basic	2453	32.9%		1185	15.9%	
	Proficient	613	8.2%		2803	37.6%	
	Advanced	182	2.4%		421	5.6%	
	Total	7452	100.0%		7452	100.0%	
Dropouts:							
	Not Tested	815	32.0%	649.3	798	31.3%	646.1
	Minimal	1233	48.4%		892	35.0%	
	Basic	443	17.4%		404	15.9%	
	Proficient	50	2.0%		441	17.3%	
	Advanced	7	0.3%		13	0.5%	
	Total	2548	100.0%		2548	100.0%	

in terms of grade 8 test scores were off-track by the end of their freshman year, and conversely, more than 40% of those in the lowest quartile in terms of grade 8 test scores were on track at the end of grade 9. Chicago researchers speculate that this apparent contradiction is because *high schools themselves,* and the *transition from middle to high school,* play a substantial role in determining whether students are on track or off-track for graduation, in a way that is not always obvious from looking at students' educational outcomes prior to entering high school.

In other words, a major conclusion emerging from Chicago research – which is mirrored in MPS findings - is that entry into 9th grade represents a critical, "make or break" point that can't necessarily be predicted by even the most robust prior (middle school) outcome data.

22 Mean scale scores in Table 6 reflect the "old" WKCE scale that was used until 2005-06, when a new scale accompanied the new WKCE containing Wisconsin-customized items in reading and math.

23 The "not tested" count reflects students who either graduated from or dropped out of MPS high schools, but for whom no grade 8 WKCE scores were available. This would be because either (a) they were enrolled in MPS as 8th graders, but were not administered the WKCE, or (b) they enrolled in MPS after the grade 8 WKCE had been administered, and then remained enrolled long enough to either graduate from or drop out of an MPS high school.

TABLE 7: COMPARISON OF FIRST-YEAR MOBILITY RATES BETWEEN DROPOUTS AND GRADUATES AMONG FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03

	2001-02:		2002-03:		2-YEAR COMBINED:	
	DROPOUTS (N=1218)	GRADUATES (N=3762)	DROPOUTS (N=1330)	GRADUATES (N=3690)	DROPOUTS (N=2548)	GRADUATES (N=7452)
Retention in Grade 9:						
Mobile	8.7%	4.4%	13.4%	4.3%	11.2%	4.4%
Not mobile	91.3%	95.6%	86.6%	95.7%	88.8%	95.6%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mean # of school changes during first year	0.09	0.04	0.13	0.04	0.11	0.04

Mobility

Mobility during the first year of high school represents another risk factor for dropping out, although it appears that this variable – at least as measured and reported here - is somewhat less useful in predicting dropout likelihood than might be expected. Mobility as shown in Table 7 captures any student who switched schools during their first year of high school based on monthly attendance records available from the MPS data warehouse. As such, any instance of a student being enrolled in a school during a particular month that was different from his/her school the prior month is captured using this method. Among first-time MPS 9th graders across the two cohorts combined (2001-02 and 2002-03), a much higher share of eventual dropouts (11.2%) than eventual graduates (4.4%) had changed schools at least once during their first year of high school, and the mean number of first-year school changes was substantially higher for dropouts than for graduates (0.11 vs. 0.04). At the same time, however, the relationship between mobility and dropout/graduation probability is not entirely straightforward. For one thing, nearly 90% of students who eventually dropped out *did not* change schools during their first year of high school. Additionally, when mobility is included in logistic regression models to predict dropout probability (see upcoming discussion), mobility is generally not a statistically significant correlate of dropping out.

PART 3. CREATING THE "TOTAL QUALITY CREDITS" INDICATOR

THE ON-TRACK INDICATOR: STRENGTHS AND LIMITATIONS

In its extensive and groundbreaking work with the Chicago Public Schools (CPS), the Consortium for Chicago School Research (CCSR) at the University of Chicago has developed an "on track" indicator for use in identifying students at elevated risk of not graduating from high school. The on-track indicator, as shown in Table 8, is based on two criteria: the number of credits attained by the end of the first year of high school and the number of failing grades received in core academic subjects (reading, math, science, and social studies). More specifically, a student is considered to be on track if s/he has attained at least five full credits (equivalent to ten half-credits for traditional semester-based classes) and has no more than one failing semester grade across the four core academic subjects during their first year of high school (Allensworth & Easton, 2005). Promotion and graduation requirements are also shown for MPS, which currently does not report any type of "on track" measure.

As CPS has both a district policy for grade 9 promotion and the CCSR on-track indicator, it is natural to wonder how both measures do in terms of predicting on-time graduation. Since the CCSR indicator is more "stringent" in that it allows fewer instances of failure in core academic subjects, it is perhaps not surprising that the on-track indicator is a far better predictor of on-time graduation than is the CPS promotion policy. While only 40% of students who met the grade 9 promotion policy wound up graduating on time (e.g., in four years), 81% of those who met the on-track requirements graduated on time (Allensworth & Easton, 2005).

Given the demonstrated utility of the on-track indicator for predicting on-time graduation as an outcome in CPS, a logical task for the development of an early warning system in MPS was to create this same measure for MPS students using transcript data. One comparison of results is seen in Figure 5, which shows the probability of graduating within five years (note that this is different from "on-time" graduation) cross-tabulated with on-track/off-track status. With 22 credits required for graduation from MPS, "on track" for MPS is defined, in

TABLE 8: PROMOTION AND GRADUATION REQUIREMENTS FOR CPS AND MPS

	GRADE 9 PROMOTION (TO GRADE 10)	FIRST YEAR OF HIGH SCHOOL "ON-TRACK" INDICATOR	GRADE 10 PROMOTION (TO GRADE 11)	GRADE 11 PROMOTION (TO GRADE 12)	GRADUATION
CPS	5 credits + must receive passing grade in at least 3 (out of 4) core subjects during both semesters of Grade 9	5 credits + no more than 1 total semester F across four core subjects for entire year	11 credits + must receive passing grade in at least 3 (out of 4) core subjects during both semesters of Grade 10[24]	17 credits	24 credits[25]
MPS	5 credits	Not in use	10 credits	16 credits[26]	22 credits[27]

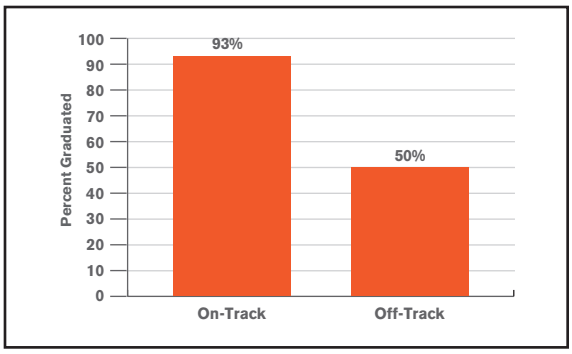
24 20 hours of community service is also required in CPS for promotion from grade 10 to grade 11.

25 40 hours of community service is also required in CPS for graduation.

26 To be promoted from grade 11 to grade 12 in MPS, a student must also be in at least his/her seventh semester (or its equivalent) of high school. See http://mpsportal.milwaukee.k12.wi.us/portal/server.pt/gateway/PTARGS_0_457088_49166_0_0_18/7_37.pdf for a full description of MPS graduation policies which are current as of this writing in spring 2010.

27 The MPS graduation requirement of 22 credits is effective with the graduating class of 2014-15. Additionally, a student must also have completed one year, and at least 5 credits, at the school from which s/he intends to graduate. A small number of MPS high schools require more than 22 credits for graduation or a different combination of courses required under the 22-credit requirement.

FIGURE 5: GRADUATION PROBABILITY BY ON-TRACK STATUS FOR END OF FIRST YEAR IN GRADE 9, MPS FIRST-TIME 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)



terms of credit attainment, the same as it is for the CPS on-track measure (5 credits earned by the end of the first year of high school).

The data show that the on-track measure is highly predictive of graduation in MPS: fully 93% of first-time MPS 9th graders in 2001-02 and 2002-03 (combined) who were on-track at the end of their first year of high school wound up graduating within five years, including 88% of whom graduated "on time" in four years). By comparison, only 50% of those who were off-track at the end of the first year of high school graduated in five years, and an even lower share (36%) graduated on time in four years.

Tables 9 and 10 present additional descriptive information with respect to the percentage of MPS students in various subgroups that are on-track among the cohorts of first-time 9th graders in 2001-02 and 2002-03 combined. Female students of all racial/ethnic groups are substantially more likely than males to be on-track, while the breakout by racial/ethnic groups shows that on-track rates are much higher for Asian and white students than for Hispanic and black students. As might be expected, special education and low-income students are similarly less likely than their non-special education and non-poor peers, respectively, to be on-track.

As useful as the on-track indicator is in terms of predicting which students are likely to graduate, however, the utility of this construct within the context of building an early warning system is constrained by at least two key factors. A first is that classifying a student as either on-track or off-track at the end of the school year is simply too late to prevent many students from dropping out. It is also less

TABLE 9: MPS ON-TRACK RATES BY STUDENTS' RACE AND GENDER FOR FIRST-TIME 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)

RACE/ETHNICITY:	FEMALE	MALE	TOTAL
African-American	58.8%	45.6%	52.9%
Asian	86.1%	71.8%	79.0%
Hispanic	64.5%	55.4%	59.9%
White	77.4%	70.4%	74.0%
Other	70.8%	65.3%	68.0%
Total	64.0%	53.1%	58.9%

TABLE 10: MPS ON-TRACK RATES BY STUDENTS' ECONOMIC STATUS AND SPECIAL EDUCATION NEEDS FOR FIRST-TIME 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)

FREE LUNCH:	SPECIAL EDUCATION	NON-SPECIAL ED	TOTAL
Yes	47.3%	58.3%	55.6%
No	52.2%	67.3%	64.6%
Total	48.8%	61.8%	58.9%

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than ideal in terms of intervening early with students who have not dropped out, but have received very low (albeit passing) grades that make future college enrollment prospects very dim. On both counts, one of the objectives of an early warning system is to provide educators with actionable information *as early as possible during a student's educational career* that can be used to preclude both of these adverse outcomes, and information that is not calculated and reported until the end of the academic year is certainly a significant limitation in this respect. Far more preferable is a measure made available earlier in the year, such as the end of the first marking period for which all students districtwide receive final grades; in MPS, this is the end of the fall semester, as the process for assigning and recording final grades is not completed on a districtwide basis until late January.[28]

A second key limitation of the on-track measure is that it essentially takes a very detailed set of student outcome information (based upon course grades and credits obtained) and reduces it to a much simpler, binary measure (yes/no, on-track/off-track). While this approach is certainly useful both in terms of accuracy (e.g., in predicting graduation) and in placing students into two readily-understood categories (e.g., on-track vs. off-track), it also discards, in effect, very valuable information for identifying how far on-track or off-track students are during their first year of high school (or, analogously, during middle school and the second year of high school and beyond). After all, a first time 9th grade student may have a GPA of 1.0 or less-- the equivalent to a D average-- but by virtue of passing these classes, may likely to be counted as "on track."

THE "TOTAL QUALITY CREDITS" INDICATOR

In response to the limitations of the on-track measure, the early warning research conducted by VARC in MPS began examining ways of showing a more complete set of outcome information associated with students' academic experiences during the first year of high school, both in terms of credit attainment and final grades received. The result is a measure called Total Quality Credit (TQC) attainment, which combines these two measures (credit attainment and final grades) into a continuous variable that can be calculated both at the end of fall semester of students' first year of high school (grade 9), as well as "backward" into middle school and "forward" to the second, third, and fourth year of high school. Additionally, by making TQC attainment during the first year of high school the outcome variable that is predicted by previous (e.g., middle school) outcome data under the two-stage recursive modeling structure described above, the utility of the TQC construct is enhanced even further, as it can be used as an early warning "shortcut" to predict the most valued high school outcomes (graduation and college enrollment) based upon *middle school data,* rather than waiting until these outcomes actually occur among high school students up to six years after initial 9th grade enrollment.

TQC AND HIGH SCHOOL GRADUATION

With this background in mind, it is useful to elaborate on how well TQC can be used to predict the two outcomes of primary interest in the MPS early warning system (high school graduation and initial college enrollment). Figure 6 shows the *five-year* graduation rates of first-time MPS 9th graders in 2001-02 and 2002-03 based upon TQC attainment during the first year of high school (year t). The data show that more than 90% of students with TQC attainment of 0.5 and higher (equivalent to a C average and higher) graduate within five years, and that in terms of predicting which students are likely to graduate, there is only a slight decline from an A average to a C average. Graduation probability begins to decline markedly below a C average (0.5 TQC), however, and is below 60% at a D average (0.25 TQC).

Figure 7, by contrast, shows on-time graduation probability (e.g., in four years) by first-year TQC attainment, and here we observe that the relationship is somewhat more linear, in that students with a C average (TQC 0.5) are less likely to graduate on time (probability of approximately

28 Some MPS high schools have grading periods prior to the end of fall semester, but the first *districtwide* data availability for this purpose are the "final marks" for fall semester that are recorded in January each year.

FIGURE 6: TOTAL QUALITY CREDIT (TQC) ATTAINMENT IN YEAR T (YEAR 1 OF HIGH SCHOOL) BY 5-YEAR GRADUATION RATE FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03

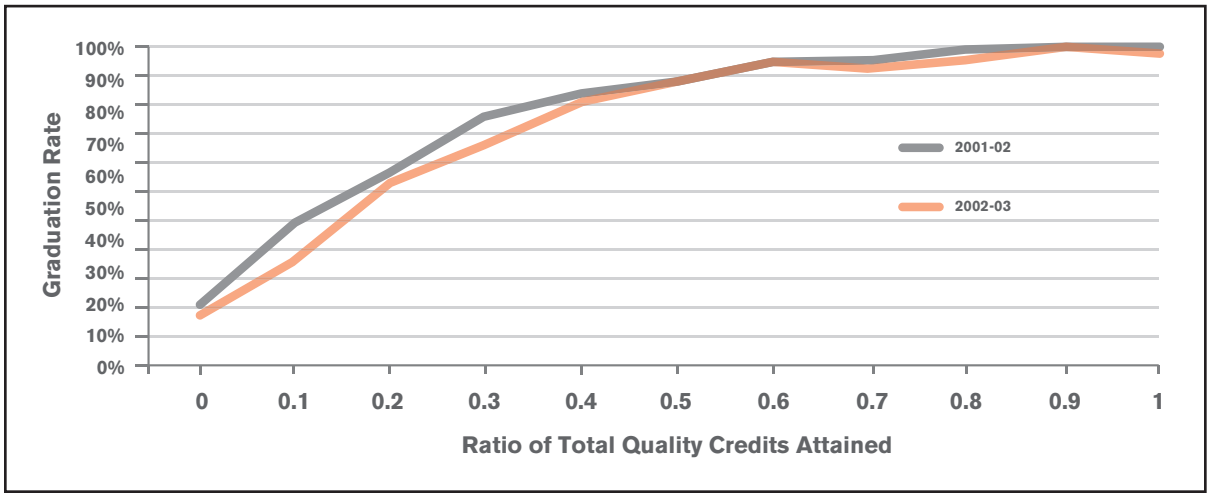
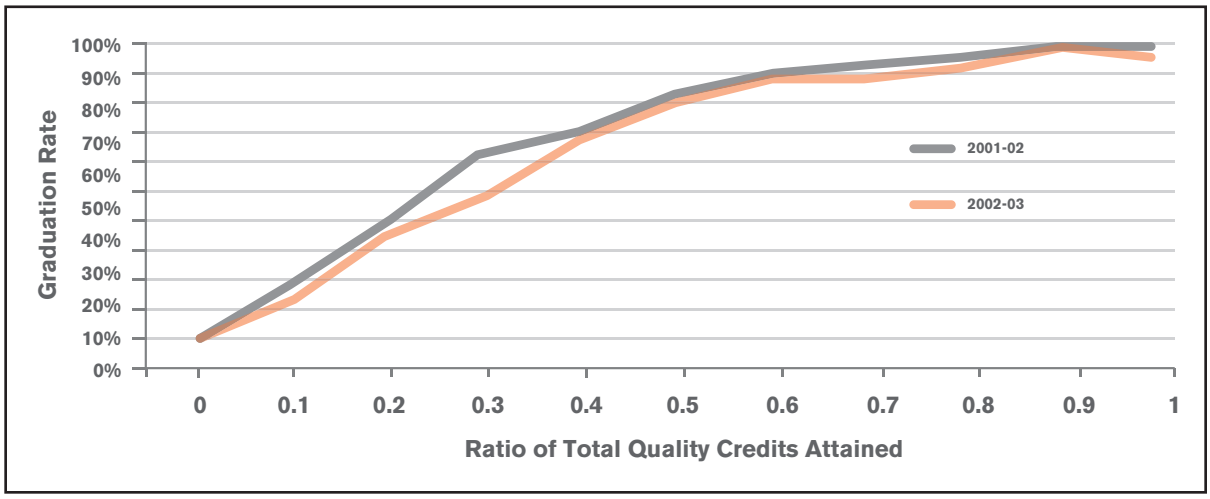


FIGURE 7: TOTAL QUALITY CREDIT (TQC) ATTAINMENT IN YEAR T (YEAR 1 OF HIGH SCHOOL) BY 4-YEAR GRADUATION RATE FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03



80%) than those with a B average (0.75 TQC; graduation probability approximately 90%). On-time graduation probability again declines markedly below a C average, such that fewer than half of those with a D average or lower graduate in four years. A key policy question emerging from Figures 6 and 7 is whether MPS wishes to have on-time graduation or five-year graduation as the outcome variable being predicted, or perhaps both. There may be some benefit to having on-time graduation as the predicted outcome, given current federal and state policies emphasizing on-time graduation, although MPS may also be interested in predicting graduation probability for students who take five years given high rates of grade 9 retention in the district.

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FIGURE 8: TOTAL QUALITY CREDIT (TQC) RATIO ACROSS HIGH SCHOOL BY 5-YEAR GRADUATION RATE FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)

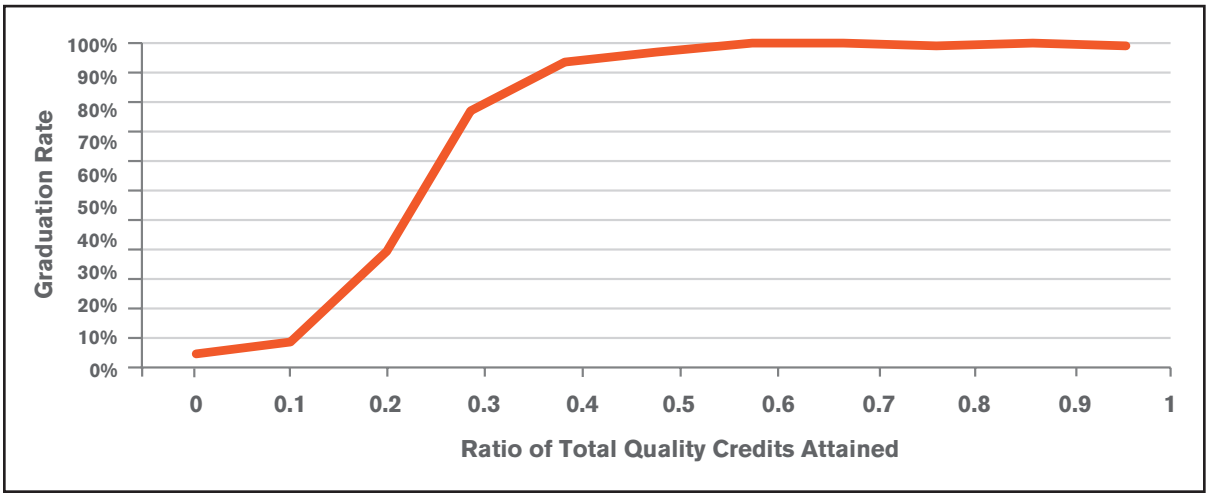
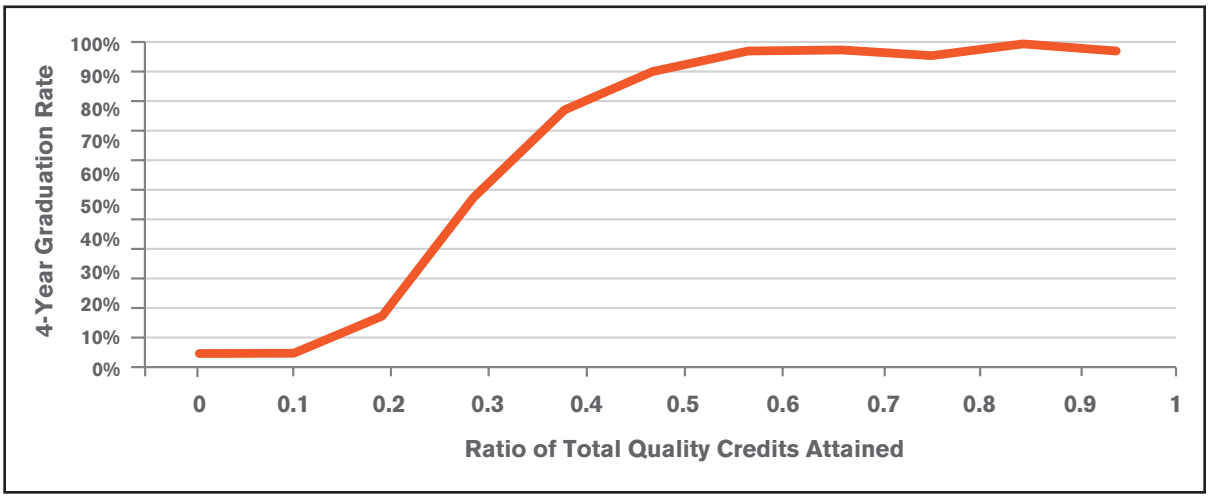


FIGURE 9: TOTAL QUALITY CREDIT (TQC) RATIO ACROSS HIGH SCHOOL BY 4-YEAR GRADUATION RATE FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)



Figures 8 and 9 show how TQC attainment over students' entire high school experiences (as opposed to the first year of high school, as portrayed in Figures 6 and 7) relates to graduation probability on both a five-year basis (Figure 8) and an on-time basis (Figure 9). Data are again for first-time MPS 9th graders in 2001-02 and 2002-03, although these two cohorts are combined here. These two figures show even more clearly the drop-off in both types of graduation probability that occur below a C average (TQC 0.5).

TQC AND COLLEGE ENROLLMENT

The relationship between TQC attainment and initial college enrollment, the second outcome of interest within the MPS early warning system, is also intriguing. College enrollment data for MPS graduates comes from the National Student Clearinghouse (NSC), which tracks and reports postsecondary enrollment information for more than 90% of high school graduates nationwide who enroll at the postsecondary level.[29] *Initial college*

29 MPS began receiving data from NSC in 2008, and has produced an initial report on findings available at http://mpsportal.milwaukee.k12.wi.us/portal/server.pt/gateway/PTARGS_0_2_52905_0_0_18/PSReport_03252009.pdf.

FIGURE 10: TOTAL QUALITY CREDIT (TQC) ATTAINMENT DURING YEAR T (YEAR 1 OF HIGH SCHOOL) BY INITIAL COLLEGE ENROLLMENT RATE FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03

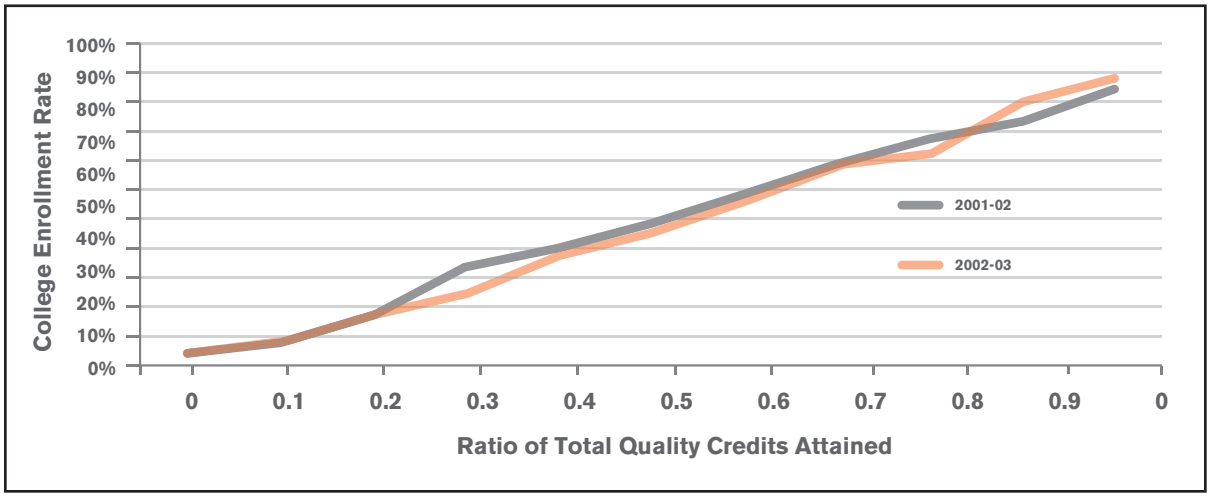
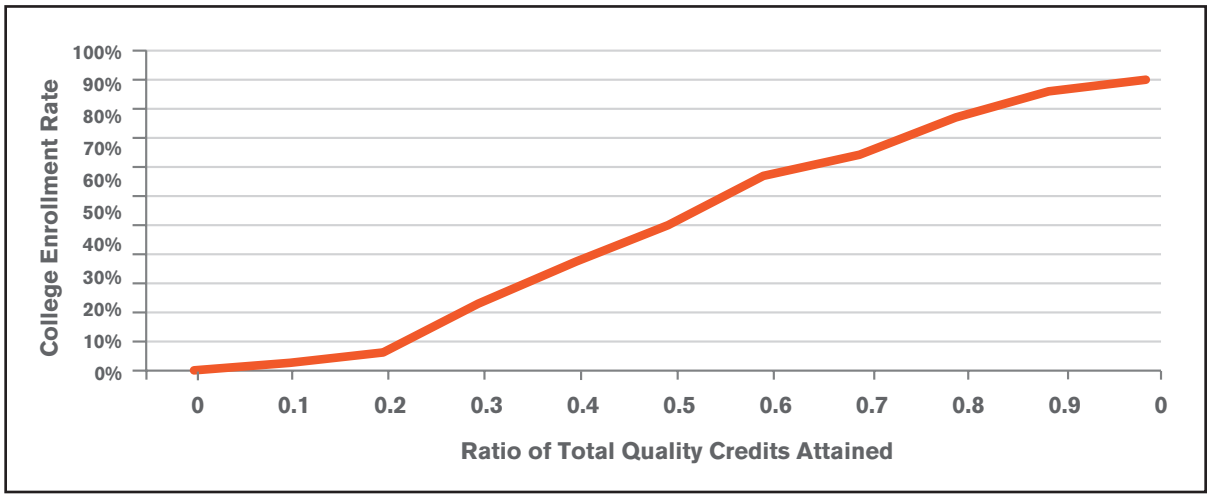


FIGURE 11: TOTAL QUALITY CREDIT (TQC) ATTAINMENT ACROSS HIGH SCHOOL BY INITIAL COLLEGE ENROLLMENT RATE FOR FIRST-TIME MPS 9TH GRADERS IN 2001-02 AND 2002-03 (COMBINED)



enrollment, as opposed to the more meaningful measures of college persistence and graduation, is used as the outcome variable for the time being, as this is the only outcome that can really be predicted using the NSC data obtained by MPS to date. MPS has received college enrollment data for its graduating classes of 2005-09; while a small number of these students (less than 100) have obtained two-year (associates) degrees, very few have been enrolled long enough to obtain four-year degrees. Clearly, college graduation is the long-term variable of the greatest interest given its impact on lifetime earnings, and the MPS early warning system will switch to using this as the second outcome variable to be predicted (joining high school graduation) as soon as sufficient data exist for this purpose.

Figure 10 shows initial college enrollment rates by TQC attainment during the first year of high school (year t), while Figure 11 shows initial college enrollment by total TQC attainment across four years of high school (years t through t+3). A generally linear pattern emerges, in

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which probability of initial college enrollment steadily increases with TQC attainment level; in other words, students whose TQC attainment is the equivalent of an A average, both in year t and across four years of high school, are observably more likely to enroll in college than those with the equivalent of a B average, who are in turn more likely to enroll than those with a C average. Very few students who graduate with a D average or below, by contrast, enroll in college. Both figures show, for example, that approximately 80% of students with first-year TQC attainment of 1.0 (equivalent to all A's in core-subject courses) enroll in college, compared to about 60% of those with TQC of 0.75 (equivalent to a B average in core-subject courses) and about 40% of those with TQC of 0.5 (equivalent to a C average). At a TQC level of 0.25, equivalent to a D average, college enrollment rates decline to less than 20%. This finding stands in partial contrast to TQC attainment and graduation probability shown previously, in which students with the equivalent of a C average were only marginally less likely than their peers with an A average to graduate, but the probability of graduation fell off markedly below a C average.

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PART 4. COMBINING RISK FACTORS INTO AN EARLY WARNING SYSTEM

Having investigated the descriptive relationships that exist between individual independent (predictor) variables (such as academic attainment as measured by TQC, attendance, mobility, retention, etc.) and the desired high school outcomes (graduation and initial college enrollment), the next step was to combine these risk factors into predictive models for understanding TQC attainment at the end of the first year of high school. In the broadest sense, this work seeks to uncover which combinations of risk factors, at various grade levels following entry into grade 6 and continuing through high school, provide the greatest predictive power for understanding which MPS students are at the highest risk of not graduating and not enrolling in college.[30]

To investigate how well various combinations of middle school outcomes (years t-1, t-2, and t-3) predict first-year of high school TQC, and to determine which middle school predictors serve as the most important predictors of first-year TQC, a series of regression analyses using first-year TQC attainment among first-time MPS 9th graders in 2005-06 and 2006-07 (combined) as the dependent variable were prepared. Independent (predictor) variables used in the analyses include the following:

School type from which a student graduated" from 8th grade (K-8 vs. traditional middle school vs. middle/high school)

- Grade 8 WKCE reading and math proficiency level
- Absence rates during each year of the middle grades
- TQC attainment during each year of the middle grades
- Instances of mobility during each year of the middle grades (mobile vs. not mobile)
- Retention during each year of the middle grades (retained vs. not retained)
- Suspensions during each year of the middle grades (suspended vs. not suspended)
- Student demographics (gender, race/ethnicity, ELL, special education, economic status)

A summarized version of results is shown in Table 11, and inferential findings are discussed in the next section.

30 It is worth reiterating here, as discussed above, that under the two-stage recursive data modeling structure used in this project first-year TQC attainment is the outcome variable being predicted, rather than the end-of-high school outcomes themselves. This is because first-year TQC serves as a "shortcut" to the two desired long-term early warning outcomes (graduation and college enrollment) by being highly predictive of these two outcomes and because first-year TQC can itself be predicted using middle school outcomes. It is also worth emphasizing that the results described are preliminary, in the sense that much more work is anticipated in order to develop the most useful and accurate early warning tools for MPS.

FINDINGS/DISCUSSION

FINDINGS/DISCUSSION

Thus far, three main inferential findings have emerged from our analyses, although given the interim nature of this report, we expect that additional findings of interest will emerge in the near future. These include the following:

Finding #1. "High yield" indicators of students at risk for dropping out of MPS and graduating with low college/workforce readiness include academic achievement (TQC), attendance, suspension, and retention/overage.

Looking at the results of the regression analyses in Table 11, it was possible to identify a set of "high yield" indicators-- those independent variables that showed a statistically significant effect on first-year TQC-- for purposes of identifying students at risk. In the case of the MPS early warning system, academic achievement (as measured by TQC), attendance, suspension, and retention/overage as the four emerged as the most important predictors.

While Grade 8 WKCE performance in both reading and math also showed a significant association with first-year TQC (e.g., students who are proficient and advanced in 8th grade usually have higher first-year TQC, and vice versa), it is worth recalling from Table 6 that 8th grade WKCE performance does not provide a consistently useful basis for differentiating dropouts from graduates, due in large part to the fact that so many MPS students who did eventually graduate performed poorly (in terms of both scale score and proficiency level) on the test.[31] And while Table 11 shows that school type (K-8 vs. traditional middle school) had a statistically significant effect on the dependent variable, given the limitations to the construct validity of this variable we feel it warrants further investigation before being identified as a "high yield indicator." These results and limitations are addressed in a separate discussion below.

It is interesting to note that among the demographic variables included in the model, special education status has a positive coefficient, which is perhaps different than what might expected given that special education students tend to have lower rates of graduation and college enrollment than their peers. This appears to be a product of the decision to include all core-subject courses in TQC calculations, rather than just those core courses that count toward MPS graduation requirements. In other words, by incorporating all core courses in TQC calculations – including the remedial, or "helper," courses noted previously, which many special education students take, and presumably fare better in than they do in "regular" core courses – special education status appears to be positively associated with TQC attainment, when we strongly suspect that this is not really the case. Subsequent analyses have applied a "partial" (0.5) weighting to remedial courses in order to strike an appropriate balance between excluding these outcomes completely and including them at a "full" weighting.

Finding #2. The ability to predict first year high school outcomes thus far using middle school indicators is somewhat limited. Among other implications, this suggests that the transition to high school presents a significant challenge for many middle grades students in MPS, even those with relatively high levels of performance through the middle grades.

One very important observation is that using even the most complete sets of middle school outcomes provides somewhat limited predictive power in terms of predicting end of first-year high school (year t) TQC attainment – and having multiple years of middle grades outcomes appears to be minimally, if at all, helpful in predicting first-year TQC attainment. The r-squared values for predicting first-year TQC using all combinations of middle school predictors (t-1 or 8th grade alone, t-1 + t-2 together, etc.) are all in the 0.25 – 0.35 range, meaning that only 25-35% of the variance observed in the dependent variable (first-year TQC) is explained by the sets of independent (predictor) variables shown in Table 11. The r-squared value from using just t-1 (grade 8) variables to predict first-year TQC, for example, is 0.36, with no additional predictive power generated by adding t-2 (grade 7 for

31 It might be useful to incorporate WKCE data into regression analyses as a scale score (e.g., a continuous variable) either in place of or in additional to its use as a proficiency level (e.g., a categorical variable). Since the WKCE scale changed from the 2004-05 to the 2005-06 test, however, using proficiency level provides a more consistent interpretation of results across time given that two separate cohorts (first-time MPS 9th graders in 2005-06 and 2006-07) are used in the analysis.

TABLE 11: REGRESSION MODELS FOR PREDICTION OF FIRST-YEAR TQC ATTAINMENT USING MIDDLE GRADES (T-1, T-2, T-3) OUTCOMES

VARIABLES	USING T-1 VARIABLES ALONE		USING T-1 AND T-2 VARIABLES		USING T-1, T-2 AND T-3 VARIABLES		USING T-2 VARIABLES ALONE		USING T-2 AND T-3 VARIABLES		USING T-3 VARIABLES ALONE	
	COEFF.	STD. ERROR	COEFF.	STD. ERROR	COEFF.	STD. ERROR	COEFF.	STD. ERROR	COEFF.	STD. ERROR	COEFF.	STD. ERROR
Intercept	3.18	0.27	3.25	0.30	3.38	0.34	7.39	0.21	6.97	0.25	7.09	0.23
K8_t-1	-0.50***	0.11	-0.57***	0.12	-0.71***	0.15						
Middle/High_t-1	0.29*	0.16	0.17	0.16	0.23	0.17						
Other type_t-1	0.57	0.39	0.49	0.41	0.59	0.43						
WKCE Math Profic. Gr.8	0.85***	0.06	0.86***	0.06	0.83***	0.07						
WKCE Reading Profic. Gr.8	0.40***	0.06	0.41***	0.07	0.43***	0.08						
% Absent_t-1	-9.81***	0.50	-8.25***	0.69	-8.37***	0.79						
% Absent_t-2			-2.12***	0.79	-0.37	1.00	-8.89***	0.49	-5.47***	0.77		
% Absent_t-3					-1.40	0.98			-3.66***	0.85	-7.74***	0.53
TQC_t-1	0.24***	0.01	0.23***	0.01	0.21***	0.01						
TQC_t-2			0.01	0.01	-0.01	0.02	0.23***	0.01	0.14***	0.01		
TQC_t-3					0.04***	0.01			0.12***	0.01	0.22***	0.01
Mobile_t-1	-0.18	0.19	-0.03	0.23	0.00	0.26						
Mobile_t-2			-0.11	0.21	0.09	0.26	-0.11	0.19	0.06	0.24		
Mobile_t-3					-0.12	0.22			-0.15	0.21	-0.35*	0.19
Retained_Gr8	-0.80***	0.30	-0.82**	0.34	-0.69*	0.37						
Retained_Gr7			-0.79***	0.29	-0.72**	0.33	-0.71***	0.24	-0.14	0.28		
Retained_Gr6					-0.14	0.35			-0.34	0.31	-0.56**	0.27
Suspended_t-1	-0.94***	0.10	-0.76***	0.11	-0.80***	0.13						
Suspended_t-2			-0.62***	0.12	-0.54***	0.13	-1.22***	0.11	-1.01***	0.13		
Suspended_t-3					-0.16	0.14			-0.44***	0.13	-1.02***	0.12
Female	1.04***	0.09	0.96***	0.10	0.88***	0.11	1.01***	0.10	0.84***	0.11	0.91***	0.10
Black	-0.11	0.15	0.06	0.16	-0.08	0.17	-0.99***	0.16	-0.92***	0.17	-1.30***	0.17
Hispanic	-0.88***	0.17	-0.85***	0.18	-1.06***	0.20	-1.39***	0.19	-1.56***	0.21	-1.72***	0.20
Asian	0.83***	0.23	0.88***	0.24	0.61**	0.26	0.64**	0.26	0.15	0.28	0.14	0.27
Special_Ed	1.60***	0.13	1.71***	0.14	1.75***	0.16	0.35***	0.12	0.50***	0.14	0.44***	0.13
ELL	0.76***	0.28	0.77**	0.30	0.70**	0.34	-0.02	0.25	0.03	0.30	0.07	0.29
Free_Lunch	-0.31***	0.11	-0.20*	0.12	-0.21	0.13	-0.53***	0.12	-0.52***	0.13	-0.60***	0.13
# observations	8134		7089		5740		8375		6595		7438	
R-Squared	**0.36**		**0.36**		**0.37**		**0.26**		**0.27**		**0.25**	

***denotes statistical significance at the .01 level, **denotes significance at .05, and *denotes significance at .10.

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most students) data and only very minimal power from adding t-3 (grade 6 for most students) data. R-squared values drop even more when t-1 (grade 8) data are excluded from the models, dashing the notion that we know as much about predicting first-year TQC in years t-2 and t-3 as we do in year t-1.

In other words, what appears to be happening is that many MPS students who have done reasonably well throughout middle school in terms of both academics and engagement (e.g., attendance and behavior) experience substantial academic deficiencies during their first year of high school. As shown previously in descriptive findings on MPS dropouts, these negative experiences during the first year of high school often culminate in students either repeating 9th grade or dropping out altogether - whether during the first year of high school itself or over a longer process of disengagement that may persist into the second, third, and even fourth years. Additionally, it does not appear that first-year TQC can be predicted as well using 6th and 7th grade outcome data as can be done using 8th grade outcomes, so adding predictor variables from additional years prior to grade 8 does not help much.

Finding #3. Irrespective of school type (K-8 vs. traditional middle), some MPS middle schools appear to be doing a better job than others in preparing students for the rigor of high school.

The inclusion of school-level indicators to identify both the middle school from which each MPS student "graduated" as well as the school(s) they attended during their first year of high school also told an interesting story. Looking at the relationships between middle school outcomes and first-year TQC, both for the district overall and broken out by school type (e.g., K-8 vs. traditional middle school), obscures important differences that may exist between individual schools which MPS students attend in the middle grades. In other words, it may be the case that stronger relationships between middle grades outcomes and first-year TQC emerge for some schools than for others. If so, this would suggest that some schools are doing a better job than others in preparing students for the rigor of high school. It may further suggest that having the right "match" of graduating 8th grade student to high school acts as a critical determinant of success at the high school level and beyond, in much the same way that the matching process of high school graduate to college has been shown to be very important as a determinant of college success (Roderick et al, 2008).

Before delving into results which investigate this hypothesis, there are a number of issues inherent in studying school-level predictive relationships between outcomes at the middle grades and those at the high school level that should be mentioned briefly. A first is that the school from which a student "graduates" from middle school is represented somewhat incompletely in this analysis, as what is used here is only the school from which a student completed 8th grade rather than a complete accounting of mobility in grades 6-8. With respect to the notion of "matches" between the middle and high schools that students attend, furthermore, MPS has no clearly-defined feeder patterns through which students from a selected set of middle or K-8 schools are "funneled" to specific high schools. This means that there are a great many potential matches between "sending" middle/K-8 schools and "receiving" high schools - with small numbers of students involved in many of these matches - making it difficult to track this process in a meaningful way. Additionally, the high school landscape in MPS has evolved substantially over the past 5-10 years, with considerable numbers of schools opening and closing, converting to charter status or reverting back to "traditional" status, adding or dropping grades, etc., which further complicates an already-complex situation.

With these caveats in mind, a sampling of results comparing the relationship between middle grades outcomes and first-year TQC for individual MPS schools that enroll middle grades students appears in Table 12. Results are restricted to 33 schools which had at least 50 "graduating" 8th graders in the 2005-06 and 2006-07 school years combined, and schools are assigned a fictitious school code at this point due to the very preliminary nature of the results.

TABLE 12: REGRESSION RESULTS FOR PREDICTION OF FIRST-YEAR TQC ATTAINMENT USING MIDDLE GRADES (T-1, T-2, T-3) OUTCOMES, BY "GRADUATING" 8TH GRADE SCHOOL SITE

SCHOOL # (FICTITIOUS)	# OF STUDENTS IN REGRESSION	COEFFICIENT ON TQC T-1	STD. ERROR	R-SQUARED
1	99	0.3988	0.0669	0.6434
2	78	0.4698	0.1845	0.5858
3	65	0.4810	0.1851	0.5535
4	91	0.4298	0.1102	0.5457
5	78	0.3683	0.1569	0.5238
6	275	0.7062	0.0622	0.5048
7	205	0.6189	0.0780	0.4940
8	88	0.7465	0.1592	0.4830
9	459	0.2602	0.0262	0.4712
10	59	0.5256	0.2537	0.4622
11	54	0.3961	0.2173	0.4391
12	116	0.6051	0.1037	0.4291
13	81	0.2138	0.1179	0.4284
14	427	0.4854	0.0452	0.4277
15	400	0.4303	0.0520	0.4229
16	455	0.3831	0.0538	0.4028
17	486	0.5421	0.0613	0.3946
18	430	0.3668	0.0493	0.3918
19	63	0.5079	0.1754	0.3886
20	94	0.5923	0.1485	0.3831
21	330	0.3415	0.0502	0.3818
22	252	0.3678	0.0674	0.3815
23	405	0.3830	0.0498	0.3807
24	80	0.2166	0.2023	0.3773
25	394	0.1953	0.0412	0.3733
26	99	0.4761	0.1260	0.3698
27	554	0.3140	0.0428	0.3568
28	420	0.4763	0.0551	0.3559
29	91	0.4614	0.1625	0.3439
30	337	0.2932	0.0673	0.2984
31	77	0.3089	0.1380	0.2956
32	117	0.3146	0.1978	0.2931
33	53	0.5784	0.3054	0.2028

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Looking at these results, there does appear to be support for the notion that some schools are doing a better job than others in preparing students for high school. The r-squared values for individual middle/K-8 schools vary substantially, from instances in which the predictive relationship between middle grades outcomes and the TQC attainment of these same students at the end of their first year of high school is fairly high (with r-squared values of 0.64, etc.) to other instances where the predictive relationship is much lower (with r-squared values in the 0.2 range).

Of course, more in-depth exploration and confirmation is clearly needed. For example, it would be very useful to investigate whether urban districts other than MPS have uncovered more robust predictive relationships between outcomes in the middle grades and those early on in students' high school careers, and whether this notion of "pairings" between middle schools and high schools appears to be important.

IMPACT OF SCHOOL TYPE

Investigating the impact of school type upon prediction of first-year TQC is based upon prior research (Neild, Stoner-Eby, & Furstenberg, 2008; Allensworth & Easton, 2005; Balfanz & Legters, 2006) which has identified the transition from the middle grades to high school as a critical point in the educational trajectory of many students. This research raises the question of whether the relationship between first-year TQC and middle grades outcomes for the district overall might be obscured by the type of school attended by MPS students during the middle grades.

Beginning in the early 2000s, MPS (as well as other urban districts) converted many of its traditional elementary schools (e.g., those with grade configurations of K-5 or K-6) to a K-8 configuration, based in large part on research suggesting that outcomes in middle grades (including both academic achievement and measures of student engagement such as attendance and behavior) would improve by eliminating the transition from elementary to middle school and by providing a more nurturing learning environment (see Juvonen et al, 2004). As a result, the number of traditional (6-8) middle schools in MPS has dwindled from 31 in 1998-99 to 11 as of the 2009-10 school year,[32] compared to 63 schools with a K-8 or 1-8 configuration in 2009-10. The reduced number of remaining middle schools in 2009-10, however, are large enough that more than one-third (34.2%) of the district's total enrollment of 15,656 in grades 6-8 is found in traditional middle schools, compared to 56.4% of 6-8 enrollment in K-8 sites and 9.0% in elementary/secondary schools with grade configurations such as 6-12 or 7-12. [33]

To investigate whether one type of middle grade configuration (K-8 vs. traditional middle school) produced superior outcomes for students, MPS commissioned two evaluations on the topic (see Cook, 2005; Cook & Bloom, 2007). The first concluded that on selected measures of student engagement, academic achievement/attainment, and value-added growth measures, K-8 schools seemed to outperform traditional middle schools. The second evaluation again found superior results for K-8 schools in the areas of student engagement and achievement/attainment, but also found that value-added growth was significantly higher in traditional middle schools.

It is important to emphasize that these evaluations focused on differences in student outcomes during the middle grades themselves, rather than outcomes at the high school level. In other words, these evaluations did not specifically address the question of whether either school type produces more favorable results after students transition to high school.

Returning to the MPS early warning discussion, a question of obvious interest given MPS's move toward K-8 schools is whether school configuration type during the middle grades (K-8 vs. traditional middle school) influences the ability to predict TQC attainment during the first year of high school. Accordingly, we included school type as a

32 In addition to the 11 schools with a 6-8 grade configuration in 2009-10, MPS has two schools with a 6-9 grade configuration that are classified as middle schools by the Wisconsin Department of Public Instruction.

33 A very small number of MPS middle grades students (0.3%) were enrolled in high schools in 2009-10.

variable in regression equations, based upon the school in which students completed 8th grade. One hypothesis here was that K-8 schools might be less effective than traditional middle schools in terms of preparing students for the academic rigor and social adjustment of high school; this might be because middle schools by design have several key structural components (including elective classes, a daily bell schedule, and mostly different teachers for each subject) that more closely resemble high school than is the case with the more "elementary-centric" model of the K-8 school. It might further be hypothesized that traditional middle schools use more rigorous and demanding grading practices than do K-8 schools, perhaps because middle schools were originally conceived some 50 years ago as a "halfway" point, or transition, from elementary to high school.

Regression results shown in Table 11 provide some support for the notion that the relationship between middle grades outcomes and first-year TQC is stronger for students who complete 8th grade in a traditional middle school. In the regression itself, it is necessary to choose one of the three main school types that MPS students attend in the middle grades (K-8, middle, or middle/high) as the reference group against which an effect of school type can be compared. Traditional middle schools were chosen for this purpose, meaning that the coefficients for K-8 and middle/high schools reflect either a positive or negative effect on the dependent variable (first-year TQC) relative to middle schools. The negative (and statistically significant) effect observed for K-8 schools indicates that students who "graduate" from 8th grade in a K-8 school are at a disadvantage relative to their peers who complete grade 8 in a traditional middle school after holding constant all other predictors.

This finding should be interpreted with caution, as using school type as an independent variable in this manner (e.g., capturing the school from which a student "graduates" from 8th grade) does not necessarily account for the length of time a student spent in a particular school type during the middle grades. In other words, just because a student completed 8th grade in a K-8 school does not mean that s/he spent all, or even most, of his/her middle grade enrollment period in that same type of school; s/he could have transferred to a K-8 school from a traditional middle school sometime during grade 8, or even in grade 6 or 7. As such, a more complete accounting for the effect of school type during the middle grades would perhaps limit analyses to include students who started and completed grades 6-8 in the same school type (K-8 vs. middle), although high rates of mobility during the middle grades would likely limit sample size considerably.

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OTHER VARIABLES OF POTENTIAL INTEREST

Several other completely different explanations may also exist for the findings encountered thus far, and possibilities such as these form the next phase of early warning work in MPS. It may be the case, for example, that the information currently available is judged insufficient for producing predictions for the outcomes of interest (graduation and college enrollment/graduation), and that additional information from the middle and/or high school grades is needed. One potential source of additional information might be some type of academic "stress test" administered at one or more points during the middle grades that was somehow able to tap into skills and constructs needed for success in high school that are not currently addressed by existing measures such as final course grades. This might be an academic exercise that is either already in use in the district or could be incorporated fairly easily (for example, a research or term paper assigned to 7th graders each year); another possibility might be a "skills inventory" for each student filled out by their teachers each year in the middle grades that measures teacher perceptions of student readiness for success at the high school and college levels.

Developing a way to measure students' level of engagement with, and "connectedness" to, their middle and high schools may also offer a useful source of information for predicting which students are less likely to graduate and enroll in/graduate from college. Several surveys which purport to measure various combinations of these psychological constructs are known to exist, including Gallup Student Poll, the EdVisions HOPE survey, and the High School Survey of Student Engagement. Research (see, for example, Close & Solberg, 2008) has indicated that tapping into these constructs can be very useful for predicting certain outcomes, such as higher attendance rates and improved GPA. MPS currently administers an annual Climate Survey to all students in grades 4 and higher that might incorporate these kinds of measures, but at the present time two substantial constraints exist: first, the current Climate Survey contains limited information that specifically addresses students' perceptions of being connected to their school; and second, no student-level response data are collected, so it would be impossible to connect results to academic outcomes within an early warning system in a way that identified students at elevated risk. As such, it might be useful to investigate the feasibility of augmenting the district's existing Climate Survey with more robust measures of student "connectedness" to their school.

CONCLUSION

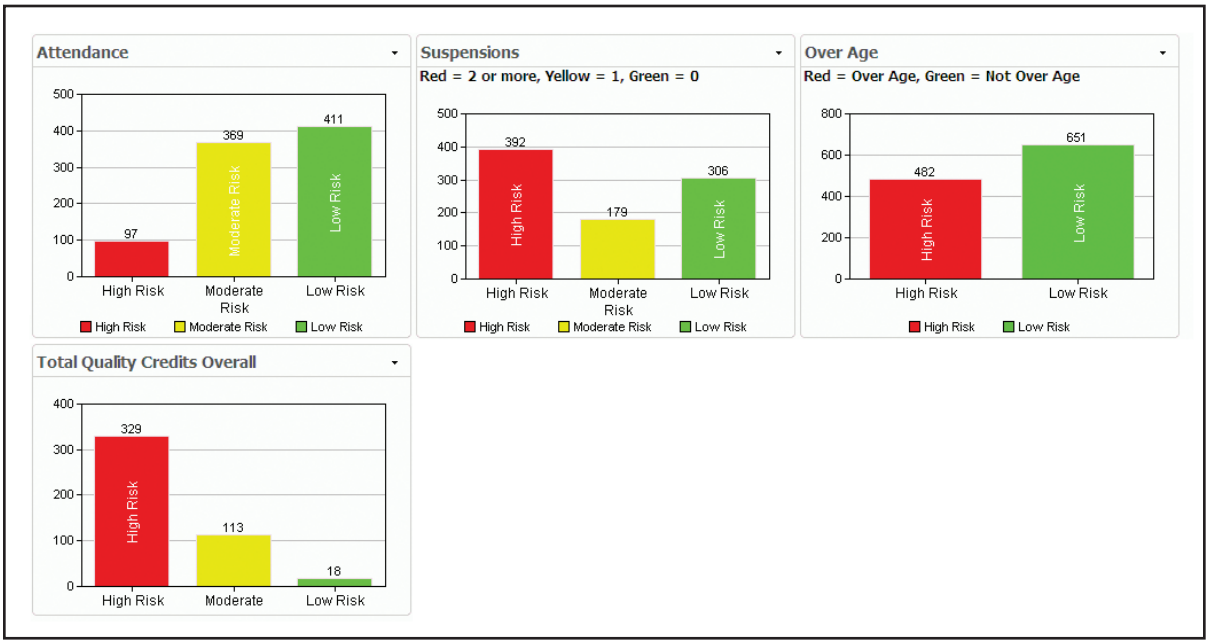
CONCLUSION

USING EARLY WARNING RESULTS TO IMPACT PRACTICE

While the research component of the MPS early warning system conducted by VARC continues, we are pleased to report that the district has already taken steps to incorporate early warning findings into "products" intended to inform district improvement efforts. MPS has developed an "early warning dashboard" at the high school grades, for example, that is known as SAIL (Student Academic Indicators for Learning). SAIL provides up-to-date information for the four "high yield" indicators identified in our work and in prior research on early warning and dropout prevention efforts (e.g., in urban districts such as Chicago and Philadelphia): Total Quality Credits, attendance, suspensions, and retention/ overage. Each of the four metrics has three distinct risk groups--green (low risk), yellow (moderate risk), and red (high risk)-- based upon thresholds identified by early warning research.

A "screenshot" of this school-level summary page is shown below in Figure 12. A student-level detail report (not shown) is also accessible from this page, offering "drillable," student-level data, such as a list of students whose status on that particular indicator has placed them into a specific risk category. Data used to populate these two reports are refreshed as frequently as possible, ranging from annually (for the retention/ overage metric) to semi-annually (TQC attainment, based upon final marks awarded at the end of each semester) to daily (in the case of attendance and suspension data obtained from the MPS data warehouse). This data also "moves" with each student as s/he changes schools, a very helpful feature given high rates of mobility among MPS students.

FIGURE 12: SCREENSHOT OF SCHOOL-LEVEL SUMMARY EARLY WARNING PROTOTYPE REPORT



Our next step will be to investigate the feasibility of providing further detail within each of the risk categories shown in Figure 12 by developing and assigning to each student a "Risk Index Score" that provides a more specific estimate of risk level at various points in time for the two key outcomes identified in our work: dropping out and graduating with low levels of college readiness. The starting point for these student-level probability estimates will be the end of 8th grade; in other words, based upon all available information as of the end of 8th grade, we will generate specific probability estimates for each student expressing their probability of both outcomes as of that point in time. As additional information becomes available following each student's entry into high school, the probability estimates will be updated on a regular basis; while it would be possible to do this literally every day as attendance and suspension data are refreshed nightly, it seems more practical to start with perhaps monthly updates. Working "backward" into the middle grades, analogously, our plan is to create similar probability estimates at predetermined times (e.g., halfway through and at the end of each grade in middle school). As additional data on college persistence and graduation become available in the future, it may also be possible to include these as third and fourth outcomes to be predicted.

POLICY IMPLICATIONS

Several broader policy implications and avenues for future work both within and outside of the district have also emerged from VARC's early warning work in MPS. This work has contributed to a deeper understanding of the dropout phenomenon in MPS, which has been a persistent issue in the district and many of its urban counterparts for many years. By simply knowing more about dropouts in a descriptive sense, for example – such as when they drop out most frequently during their high school career – it is possible to design interventions to more effectively address this problem.

For example, the fact that many MPS dropouts persist well into their high school careers suggests that dropping out is best understood as a gradual process of disengagement rather than a single catastrophic event, and that efforts to better identify at-risk students based on observable outcomes during the middle grades and even the first year of high school could prove critical. At the same time, the fact that the modal grade for MPS dropouts is grade 9 suggests that additional programming targeted at easing the difficult transition from middle to high school is warranted, and that this programming should be informed by rigorous early warning data.

While early warning work conducted to date has been very promising, another policy implication emerging from our work is that additional research and development is clearly needed to both "fine tune" and expand these systems. For example, our analysis illustrates that it is misleading to think of graduates as a single, monolithic group whose trajectories for life success are largely similar. Instead, we identify a second key outcome that should be predicted by early warning systems, in addition to predicting which students are at elevated risk of dropping out: those students who are likely to graduate, but with very low levels of college and workforce readiness. These are students who have done just enough to continue accumulating credits – often by receiving D grades – but for whom the prospects of a meaningful career, with or without some type of postsecondary education – are extremely limited. The data show that very few of these students go on to college, and the fact that college and workforce readiness are increasingly thought of as very similar skill sets does not bode well for students entering the workforce after a lackluster high school career.

Moreover, the relatively low predictive power of even the most complete sets of middle grades outcomes suggests that additional data are needed in order to make early warning models more robust. One area that warrants further investigation, for example, is the notion of "matches" between individual middle schools and high schools. Future early warning work may also benefit from the development of measures of key non-cognitive outcomes such as students' sense of engagement in school and the efficacy of their support networks, as well as non-school predictive information such as students' health and family backgrounds.

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APPENDIX

DEVELOPING NEW HIGH SCHOOL VALUE-ADDED INDICATORS IN MPS

The second major line of work supported by the Senior Urban Education Research Fellowship, in addition to the Early Warning system, has involved the development of new value-added performance indicators for MPS high schools. As noted in the introductory section of this report, one of the ways in which the Fellowship has been particularly useful to the MPS/WCER research partnership is that it has contributed significantly to the expansion of our work to the high school level. Within the past year, VARC has completed a comprehensive evaluation of MPS high schools and produced the first longitudinal analysis of initial college enrollment rates among MPS graduates from the classes of 2005-09. Additionally, MPS has issued a contract to VARC to evaluate several new initiatives at the high school level, including a "Freshman Connection" program designed to produce smoother transitions from the middle grades to high school and a credit recovery program at year-round high schools.

VARC has produced annual estimates of value-added performance for all MPS elementary and middle schools since 2001, and has recently (as of this writing in spring 2010) released the most recent version of these data incorporating 2009-10 test results. Due to the fact that Wisconsin's state testing program includes only grades 3-8 and 10, however, it has not been possible to produce value-added data for MPS high schools for the past several years, as there has been no test in grade 9 with which to measure growth to grade 10. The district did administer TerraNova assessments to 9th grade students prior to the start of statewide 3-8 and 10 testing in 2005-06, and VARC was able to produce several years of value-added estimates for grade 9-10 growth using these data. No value-added data have been produced for MPS high schools for the past several years, however, following the discontinuation of grade 9 *TerraNova* testing in 2005-06.

In response to both the value-added "void" that has existed at the high school level in MPS as well as the district's deepening commitment to using value-added indicators as measures of school performance and accountability, VARC has used the Senior Urban Education Research Fellowship as a catalyst for developing pilot versions of several new value-added performance indicators for MPS high schools. Two specific pilot indicators of high school value-added developed under the auspices of the Fellowship work include the following:

- Within-year (September-May) value-added growth on MPS grade 9 quarterly benchmark exams;
- Attendance value-added for first-time MPS 9th graders using prior attendance (from grade 8) as a control;

Addressing first the pilot value-added system based upon grade 9 quarterly benchmark testing data, VARC's work in building value-added models for school improvement and accountability based upon state standardized tests such as the WKCE has had at least two key limitations for which there is no true solution under the existing testing system:

- There is a substantial "lag time" between when students take the WKCE (November) and when districts receive results (March/April), and this delay is exacerbated even further in the calculation of value-added data by the fact that value-added measures growth from year to year. As such, results from Year 2 of the value-added model are based upon tests that a student took some 18 months earlier;
- The mid-year (November) testing window associated with the WKCE (and some other state tests, to a lesser degree) greatly complicates value-added calculations and interpretations/uses, as growth must be divided across two school years (and, by association, two grade levels and classrooms, and sometimes two completely different schools).

In response to these limitations, there has been substantial growth in recent years in the number of districts and schools using shorter-cycle standardized tests known generally as "benchmark" assessments. These tests, typically administered 3-4 times annually to students in grade ranges from the early elementary to early high school grades, are ideal for expanding value-added beyond yearly NCLB-type assessments in that

they (a) return results to districts much more quickly for use in school improvement, and (b) address the issue of mid-year testing by allowing growth to be compared across more intuitive starting and ending points than is currently the case with the November-November period defined by the WKCE testing cycle. MPS launched its own benchmark testing system for students in grades 3-9 in reading and math during the 2006-07 school year. These tests, designed by Discovery Education, have been administered in September, December/January, March, and May of each year, thus allowing growth to be measured across a variety of different intervals (September-May, September-January, etc.) which do not require growth to be apportioned across multiple school years. The utility of benchmark testing for MPS schools is evident in the fact that while participation has been optional (other than for 9th graders, for whom participation is mandatory per MPS board policy), the vast majority of schools have voluntarily chosen to participate in the program.

At its core, the VARC value-added model is a regression of current achievement on past achievement, a set of student characteristics, and a full set of school or classroom indicators. A school-level model can be described using the following regression model:

$$y_{1i} = \zeta + \lambda y_{0i} + \beta' X_i + \alpha' S_i + e_i$$

where y_{1i} is student *i*'s current achievement, y_{0i} is student *i's* past achievement, X_i is a vector of student *i's* characteristics, S_i is a vector of variables indicating the schools student *i* attended, and e_i is the component of current achievement that cannot be explained with past achievement, student characteristics, or schools. The coefficients on the school indicators α is a vector of parameters that become the schools' value-added.

This model uses data on past test scores and student characteristics to produce a prediction (more specifically, a best linear prediction) of current test scores. A school's or classroom's value added is equal to the number of extra points on the test that students in that school or classroom gained on the test relative to that prediction. For example, a school in Wisconsin may have a value-added of +3 WKCE points; this means that students at that school gained 3 more points on the WKCE from one year to the next than did observationally similar students across the district.

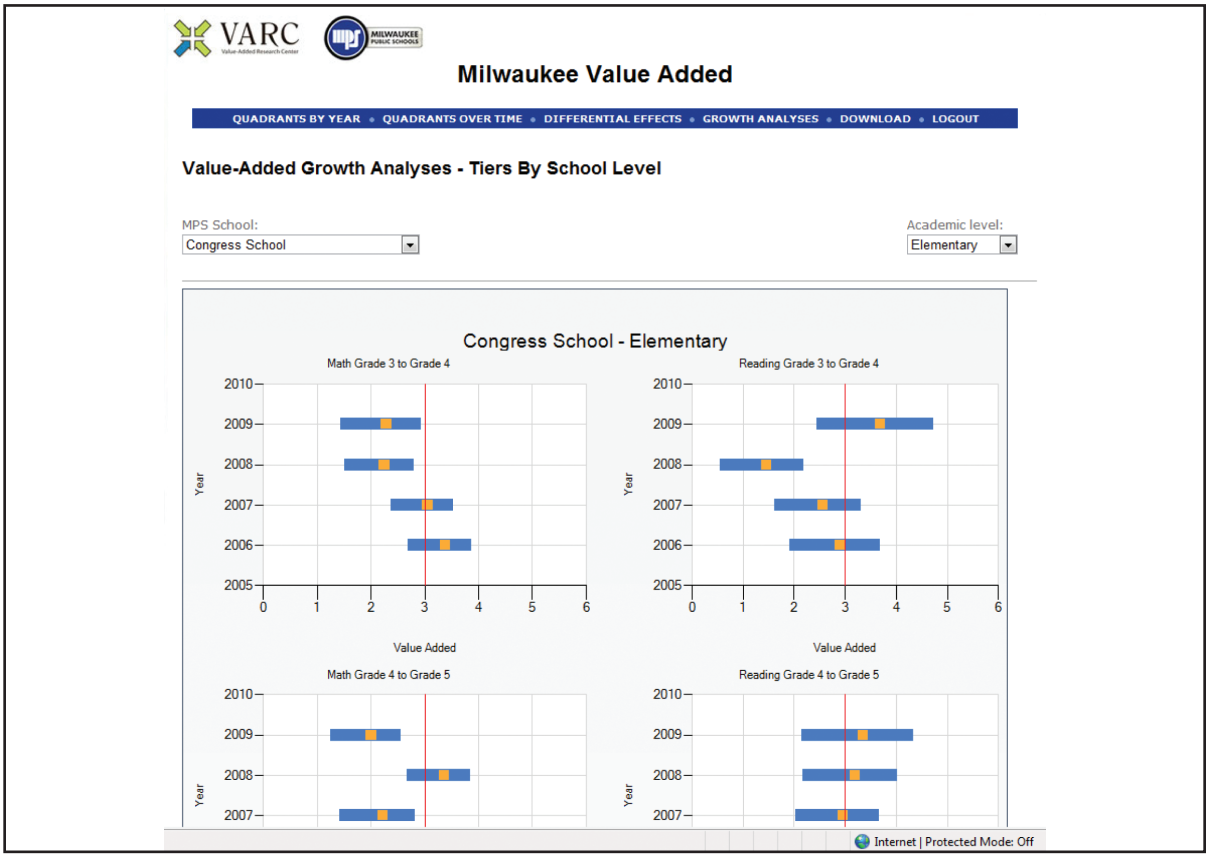
Since test scores used in value-added modeling do not perfectly measure student knowledge, particularly for scores at the margins (e.g., scores at the very low and very high ends of the score distribution), a correction for measurement error in past test scores is made to ensure there is no attenuation bias on the coefficients on past achievement. After the regression is run, the school or classroom effects αare centered to have a mean of zero. They are also "shrunk" to ensure that small schools or classrooms are not overrepresented among those with very high or low value-added.

VARC currently produces value-added results at the district, school, and grade level for many of our partner districts (including MPS), and at the classroom level for selected partners such as the New York City Department of Education. District, school, and grade-level results are depicted in two primary ways, including a "tier" format and a two-dimensional "quadrant" schematic. The tier format (see Figure 1, using an MPS report based on WKCE value-added results) displays the school (or grade's) value-added effect on scale score gain in relation to a reference point (generally the district or state average) in a standardized format on a 0-6 scale, with the district (or state) average (denoted by a red vertical line) set at 3.[34] Tier growth above 3, accordingly, signifies value-added growth above the district/state average, while tiers below 3 denote below-average growth. The value-added productivity estimate for the school/grade appears as a square situated within "error bars" that depict the confidence interval associated with the estimate; error bars are shorter (smaller) with larger sample sizes and less variance in gain scores among the students included in the year-to-year growth calculations.

34 The district/state average in VARC reporting is typically centered at 3, rather than 0, to avoid the impression of "negative" value-added (e.g., a school or grade exerted a negative effect on student growth, or a decline in scale scores from one year to the next), which would be an unlikely result for a summative (annual) test with a vertical scale such as the WKCE.

APPENDIX A: DEVELOPING NEW HIGH SCHOOL VALUE-ADDED INDICATORS IN MPS

FIGURE 1: SAMPLE REPORT FOR MPS TIER VALUE-ADDED



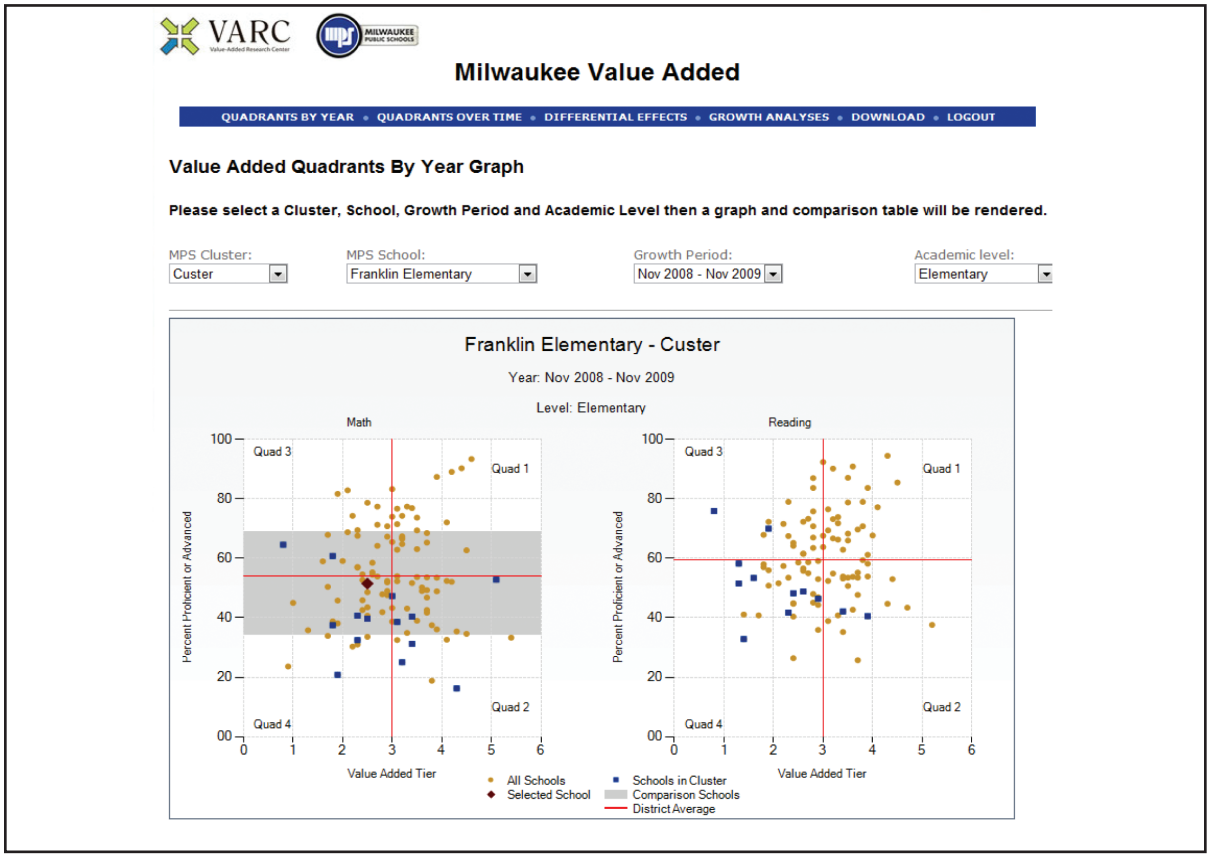
The second main way in which value-added results are displayed is in a two-dimensional quadrant format, with pre-test attainment level (generally expressed in terms of the school/grade's percent proficient/advanced) on the vertical axis and value-added tier (as described above) on the horizontal axis. By combining attainment (expressed in relation to the district or state average) and value-added data, each grade, school, or district can be placed into one of four "quadrants:"

- Quadrant 1: high value-added/high attainment
- Quadrant 2: high value-added/low attainment
- Quadrant 3: low value-added/high attainment
- Quadrant 4: low value-added/low attainment

A sample two-dimensional/quadrant report for an MPS school, again based on WKCE results, appears in Figure 2.

Applying the "base" VARC value-added model to examine within-year (e.g., September-May) growth on MPS 9th grade benchmark assessments produces results which can be displayed in the same format as those shown in Figures 1 and 2. As of this writing, data for all MPS schools which enroll 9th graders have been prepared, and we are preparing to share these data with MPS administrative staff to determine next steps. Several issues have been identified for discussion, including the fact that many MPS high schools enroll relatively small numbers of 9th graders and participation rates for the benchmark assessment system tend to be lower for most schools than is the case for the WKCE. It is also worth noting that while the experimental analyses thus far have involved within-year (September-May) growth, MPS is also interested in examining growth between other testing intervals as well (e.g., September-January, January-May, May-May, etc.).

FIGURE 2: SAMPLE REPORT FOR MPS TWO-DIMENSION/QUADRANT VALUE-ADDED



A final note on the experimental grade 9 value-added benchmark work in MPS is that VARC's collaboration with MPS in this area (e.g., expanding value-added to benchmark assessments) has generated a great deal of interest among other Wisconsin school districts in simulating these types of analyses on their own benchmark data. The most prominent example here to date is a demonstration project recently initiated with the Racine Unified School District to produce value-added productivity estimates based on data from the Measures of Academic Progress (MAP), a well-known online adaptive test[35] currently administered in nearly half of Wisconsin's 425 school districts. Racine has used the MAP to assess student growth in reading and math in grades 2-9 since 2005, and has desired to have MAP data used for value-added purposes in much the same way that value-added models are being built for MPS using its own benchmark system. In addition to its widespread use in Wisconsin and across the Midwest, however, the MAP value-added pilot project is attractive to VARC and our partner districts in that this test has a very large item pool, extensive research in vertical scale development, and smaller standard errors (due to the adaptive nature of the test) than is generally the case for non-adaptive tests such as the WKCE. There is substantial interest statewide in the findings from and uses of the MAP value-added system being developed for Racine, and as such the vision for the Racine's work is to build a statewide MAP value-added system for other interested districts to join. We envision that this would operate in much the same way that the Milwaukee Public Schools (MPS) and Madison Metropolitan School District (MMSD) served as pilot sites for VARC's statewide value-added system built using WKCE data, which was completed in June 2009 and has been expanded to more than 30 additional districts as of this writing in spring 2010.

35 Adaptive tests are those that adjust the difficulty of items taken by students in order to more precisely estimate what students know. This format differs notably from most NCLB-type accountability tests, in which most of the items taken by students are confined to the specific grade level in which the student is enrolled, regardless of whether his/her ability level is above or below that grade.

DEVELOPING NEW HIGH SCHOOL VALUE-ADDED INDICATORS IN MPS

It is also exciting to report that MPS itself has very recently approved a plan to replace its existing benchmark test with the MAP beginning with the 2009-10 school year.

The second high school value-added initiative supported by the Senior Urban Education Research Fellowship involves an attendance value-added metric for first-time MPS 9th graders. In much the same way that the benchmark assessment value-added system described above represents an exciting expansion beyond our foundational work using annual NCLB-type tests, moving value-added into non-cognitive outcomes such as attendance is another key step in developing the next generation of value-added models. This is because in addition to the obvious focus on measuring gains in student achievement through a value-added lens, a number of non-cognitive measures, including attendance, have been a chronic problem for MPS and other urban districts for some time. As one example, the year-to-date attendance rate for MPS 9th graders in mid-May 2010 was 77.4%, which is up slightly from the 76.2% year-end figure for 2008-09. This represents the equivalent of more than one full day each week missed by the average MPS 9th grader.

What is not known from looking at district-level data, however, is whether *individual high schools show better results* (which is almost certainly true), nor whether schools producing better results are doing so with *similar students in terms of demographics and prior attendance histories.* To address these questions, the value-added attendance initiative compares schools based upon the attendance rates of their first-time 9th graders using students' grade 8 attendance as a control. The emphasis on first-time 9th graders, as opposed to all 9th graders, is important due to the high rates of grade 9 retention in MPS (25-30% annually) noted previously. In other words, the model estimates high school productivity on the attendance metric using "prior achievement" (in the form of grade 8 attendance) as a control, in order that schools can be fairly compared as to how they are impacting attendance rates for students who enter high school with similar prior attendance histories.

The general attendance value-added model for first-time 9th graders can be expressed as

$$A_9 = \lambda_1 \hat{A}_8 + \alpha_{99} s_9 + \alpha_{98} s_8 + \varepsilon_1$$

Based upon the following:

A_i = grade i attendance rate

$\hat{A}_i$ = predicted attendance from IV equation.

s_i = school attended in grade i

λ =effect of prior attendance

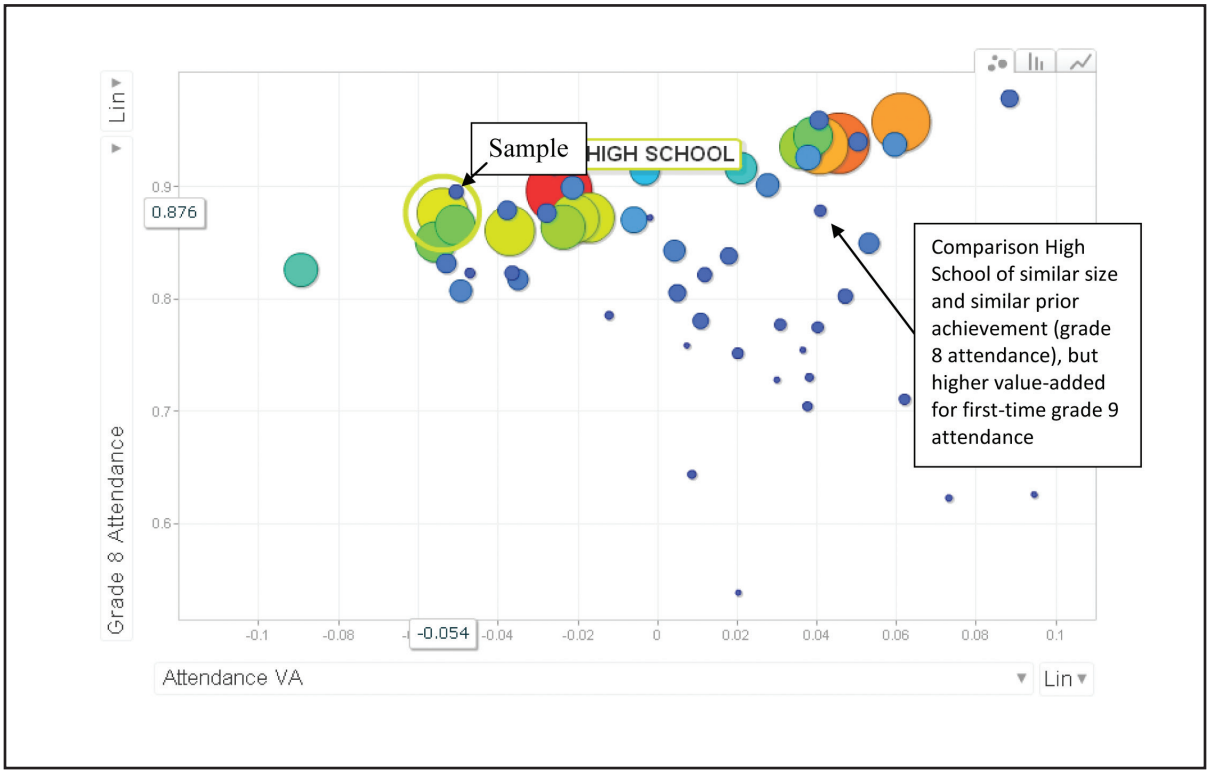
α_{ij} = effect of school attended in grade j on attendance in grade i

ε =prediction error

The current version of the model uses a transformation of the attendance variable to better model student attendance. The attendance percentage is transformed to its corresponding quantile of the standard normal distribution. Also, multivariate shrinkage is used on the school effects. The shrunk school effects represented by α_{99} in the above model is the reported 9th grade attendance value-added.

A sample version of actual results for the grade 9 attendance value-added demonstration appears in Figure 3. For each school, first-time 9th grader students' "prior achievement," in the form of their grade 8 attendance histories, is shown on the vertical axis, and the attendance value-added effect estimate for first-time 9th graders is shown on the horizontal axis in relation to the district average, which is set at zero. For "Sample" High School (which is kept anonymous for now because data from this simulation have not yet been shared with individual MPS high schools), current (2009-10) first-time 9th graders had an average 8th grade attendance rate of 87.6%, and the attendance value-added for this school was -5.4. In other words, current first-time 9th graders at this school have attendance rates that are 5.4 percentage points lower than would be expected if these same first-time 9th graders attended an average MPS high school.

FIGURE 3: SAMPLE VALUE-ADDED REPORT FOR FIRST-TIME GRADE 9 ATTENDANCE



One of the ways in which this analysis and reporting format is particularly useful is that it allows for comparisons between high schools that (a) have current first-time 9th graders with similar "prior achievement" (attendance histories as 8th graders); and (b) are of similar size. In the "live," interactive version of the report, each school is identifiable with a "mouse-over" feature in the reporting tool, and the relative size of each school is highlighted by producing different-sized bubbles within the graph based on student enrollment counts. In Figure 3, for example, it is possible to compare Sample High School to Comparison High School, since these two schools are of similar size and have current first-time 9th graders who are similar based on prior (grade 8) attendance. In making this comparison, we see that Comparison High School Reading generates a positive value-added effect for attendance among first-time 9th graders of approximately 4 percentage points, compared to Sample High School's negative effect of 5.4 percentage points.

This result, again based on actual data from the simulation, represents a "spread" in terms of attendance of more than 9 percentage points between two high schools that are observably similar along these two key dimensions – a substantial discrepancy that certainly merits further examination.

The value-added attendance model for first-time MPS 9th graders was demonstrated to MPS administrative staff in January 2010, and was met with great interest. Among other potential uses for this type of data, the district indicated that it would investigate incorporating the attendance value-added metric into future decisions regarding the approval and renewal of charter schools at the secondary level, as well as potential closings and consolidations of high school sites in future years. There is also interest in incorporating the first-time grade 9 value-added attendance metric into future versions of a school ratings system being developed for all MPS schools as of this writing in late spring/early summer 2010.

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