



Using the freshman on- track indicator to predict graduation in two urban districts in the Midwest Region





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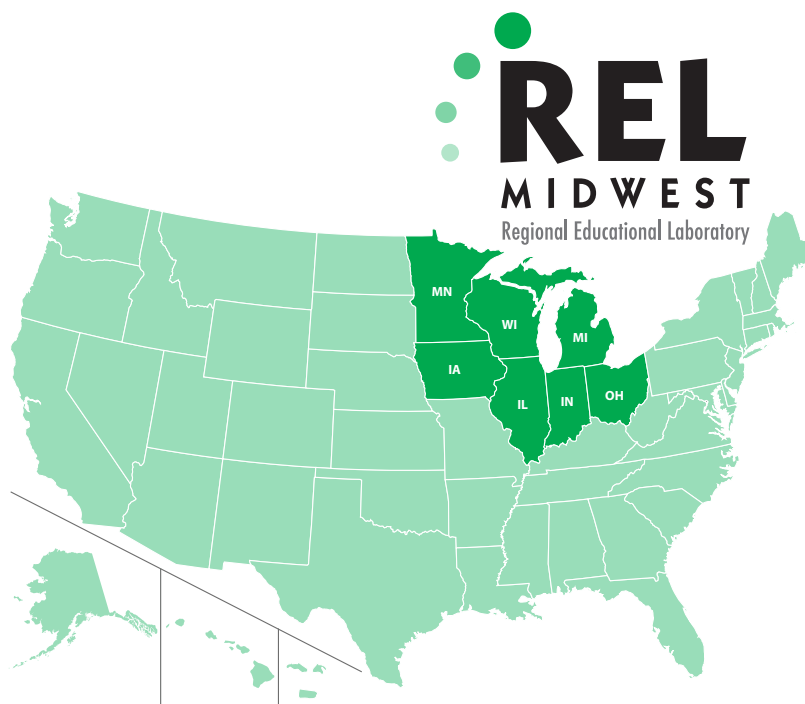
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Using the freshman on-track indicator to predict graduation in two urban districts in the Midwest Region

This study uses a measure based on grade 9 course credits earned and failures to examine four-year high school graduation rates for students classified as “on track” and “off track” to graduate in two urban Midwest Region districts. For both districts, the on-track indicator was a significant predictor of on-time high school graduation, even after controlling for student background characteristics and grade 8 assessment test scores.

Recent estimates suggest that of U.S. public high school freshmen in the fall of 2005 24.5 percent did not graduate on time in 2008/09 (Stillwell, Sable, and Plotts 2011).¹ As states and school districts attempt to boost graduation rates, they face the challenge of identifying which students are at risk of not graduating on time. Early warning indicators based on measurable student outcomes and behaviors could help identify students at risk while there is still time to redirect their trajectory away from dropping out or falling behind.

The current study focuses on the freshman on-track indicator developed by the Consortium on Chicago School Research (CCSR). This indicator identifies a student at the end of the first year of high school as on track to graduate if:

- The student has accumulated the necessary course credits in grade 9 to move to grade 10, as defined by district policy.

- The student has no more than one semester failure in any English, math, science, or social studies course.

The CCSR found that of the Chicago freshman class of 1999, 81 percent of students who were on track graduated from high school within four years compared with 22 percent of students who were off track (Allensworth and Easton 2005).

Educators want to know how consistently indicators predict graduation across districts. In a recent study, Regional Educational Laboratory (REL) Southwest found that in five Texas districts, a greater percentage of on-track than off-track students graduated within four years (Hartman et al. 2011).² However, across Chicago and the five Texas districts studied by Hartman et al., the difference in on-time graduation rates for on-track and off-track students varied considerably, ranging from 18.4 percentage points to 59.0 percentage points. This report adds to this body of research by applying the CCSR model to two additional districts (referred to as District A and District B), both in the Midwest Region.

Although the CCSR study of Chicago students found that the on-track indicator had predictive value after accounting for student background characteristics (Allensworth and Easton 2005), that study cannot predict whether this is the case in other districts. The current study

examines the extent to which the CCSR on-track indicator predicts on-time graduation in two other districts after controlling for student background characteristics and prior achievement.

The current study examined three research questions for two urban districts in the Mid-west Region:

- What were the freshman on-track and off-track rates for recent cohorts, overall and by student background subgroup?
- How did four-year in-district graduation rates compare for on-track and off-track freshmen in recent cohorts, overall and by student background subgroup?
- To what extent does the on-track indicator predict four-year graduation rates for recent cohorts in each district, after accounting for baseline student background characteristics?

The main results of the study are the following:

- For both districts, students who were on track at the end of grade 9 graduated on time at a higher rate than did students who were off track. This was the case both overall and for every student background subgroup examined in each district.
 - In District A, the graduation rate was 80.7 percent for on-track students and 30.2 percent for off-track students in the 2005/06 cohort and 77.7 percent and 30.0 percent in the 2006/07 cohort.
 - In District B, the graduation rate was 90.6 percent for on-track students and

46.1 percent for off-track students in the 2005/06 cohort and 90.5 percent and 44.7 percent in the 2006/07 cohort.³

- For both districts, the on-track indicator was a significant predictor of on-time high school graduation, even after controlling for student background characteristics and for student assessment test scores in grade 8. The odds of on-time graduation for students who were on track at the end of their freshman year was estimated to be 6.6 times that of students who had similar characteristics but were off track at the end of their freshman year for District A and 5.5 times for District B.
- For both districts, the effect size of being on track compared with being off track (as measured by increases in the odds of graduating) was larger than the effect size for every student background characteristic and for grade 8 assessment test scores.
 - In District A, the percentage of students who were on track at the end of grade 9 ranged from 41.1 percent to 51.5 percent across four cohorts. The on-track and off-track rates varied with subgroup classifications based on gender, race/ethnicity, individualized education program (IEP) status, age, and grade 8 proficiency level on the state math and reading assessments. The on-track rate for individual subgroups ranged from 25.3 percent to 73.9 percent.
 - In District B, the percentage of students who were on track at the end of grade 9 ranged from 84.6 percent to 86.8 percent across five cohorts.

The on-track and off-track rate varied with subgroup classifications based on gender, race/ethnicity, IEP status, free or reduced-price lunch status, age, and grade 8 proficiency level on the state math and reading assessments. The on-track rates for individual subgroups ranged from 67.2 percent to 97.6 percent.

The pattern of results in this study is similar to that of prior studies (Allensworth and Easton 2005; Hartman et al. 2011), with some differences in overall on-track rates, on-track rates for particular student subgroups, and the degree to which the on-track indicator differentiates between graduates and nongraduates.

Notes

1. Stillwell, Sable, and Plotts (2011) applied the averaged freshman graduation rate, a method used by the National Center for Education Statistics to estimate the percentage of public high school freshmen who graduate with a regular diploma four years after starting grade 9 (Seastrom et al. 2006a, 2006b). Under this method, the rate for 2008/09 (the freshman class in the fall of 2005) equals the total number of diploma recipients in 2008/09 divided by the average enrollment of grade 8 students in 2004/05, grade 9 students in 2005/06, and grade 10 students in 2006/07.
2. Both Allensworth and Easton (2005) and Hartman et al. (2011) calculated graduation rates by tallying the number of on-track and off-track freshmen in each district who went on to graduate on time. Students who left the district during grade 9 or who transferred into the district after grade 9 were not included in these calculations. The same method was used in this report.
3. The findings for the first two research questions show that on-track rates and on-time graduation rates were higher for District B than for District A. It is not within the scope of this study to compare the two districts, however, or to explain the underlying reasons for the on-track rates or graduation rates in either district.

April 2012

TABLE OF CONTENTS

Why this study?	1
The Consortium on Chicago School Research freshman on-track indicator	2
Study motivation and research questions	3
Study findings	4
Freshman on-track and off-track graduation rates	4
Four-year in-district graduation rates for on-track and off-track freshmen	5
Using the on-track indicator to predict four-year graduation rates	11
How these results compare with those of other studies	11
On-track rates	11
Graduation rates for on-track and off-track students	13
The relationship between on-track status and on-time graduation	14
Limitations of the study and suggestions for future research	14
Appendix A Study data and analysis	15
Appendix B Determination of on-track status and graduation status	17
Appendix C Analytic samples	18
Appendix D Graduation rates for freshmen in the 2005/06 and 2006/07 cohorts	23
Appendix E Regression model specifications and results	25
Notes	29
References	31
Box	
1 Study data and analysis	4
Figures	
1 Percentage of freshmen in the 2005/06–2008/09 cohorts in District A identified as on track or off track at the end of grade 9	5
2 Percentage of freshmen in the 2005/06–2008/09 cohorts in District A identified as on track or off track at the end of grade 9, by student background subgroup	6
3 Percentage of freshmen in the 2005/06–2009/10 cohorts in District B identified as on track or off track at the end of grade 9	7
4 Percentage of freshmen in the 2005/06–2009/10 cohorts in District B identified as on track or off track at the end of grade 9, by student background subgroup	8
5 Percentage of on-track and off-track freshmen in the 2005/06 and 2006/07 cohorts in District A who graduated within four years	9
6 Percentage of on-track and off-track freshmen in the 2005/06 and 2006/07 cohorts in District A who graduated within four years, by student background subgroup	10

- 7 Percentage of on-track and off-track freshmen in the 2005/06 and 2006/07 cohorts in District B who graduated within four years 11
- 8 Percentage of on-track and off-track freshmen in the 2005/06 and 2006/07 cohorts in District B who graduated within four years, by subgroup 12

Tables

- C1 Analytic sample exclusions for each cohort of students in District A 18
- C2 Analytic sample exclusions for each cohort of students in District B 18
- C3 Distribution of grade 9 students in the District A study samples, by research question and student subgroup, 2005/06–2008/09 21
- C4 Distribution of grade 9 students in the District B study samples by research question and student subgroup, 2005/06–2009/10 22
- D1 Percentage of freshmen in the 2005/06 and 2006/07 cohorts in District A who graduated within four years, overall and by student background subgroup 23
- D2 Percentages of freshmen in 2005/06 and 2006/07 cohorts in District B who graduated within four years, overall and by subgroup classification 24
- E1 Regression analysis results for District A 27
- E2 Regression analysis results for District B 28

This study uses a measure based on grade 9 course credits earned and failures to examine four-year high school graduation rates for students classified as “on track” and “off track” to graduate in two urban Midwest Region districts. For both districts, the on-track indicator was a significant predictor of on-time high school graduation, even after controlling for student background characteristics and grade 8 assessment test scores.

WHY THIS STUDY?

Recent estimates suggest that 24.5 percent of U.S. public high school freshmen in the fall of 2005 did not graduate on time in 2008/09 (Stillwell, Sable, and Plotts 2011).¹ As states and school districts attempt to boost graduation rates, they face the challenge of identifying which students are at risk of not graduating on time. Early warning indicators based on measurable student outcomes and behaviors could help identify students at risk while there is still time to change their trajectory away from dropping out or falling behind.

Multiple studies have shown that racial/ethnic minority students and economically disadvantaged students are less likely to graduate on time than are their White and more affluent counterparts (Aud et al. 2010; Beyond High School 2011; Orfield et al. 2004; Stillwell et al. 2011; Swanson 2009). According to one analysis, nationwide graduation rates in 2008/09 were 65.9 percent for Hispanic students and 63.9 percent for Black students, compared with 82.0 percent for White students (Stillwell et al. 2011). According to school administrators, in 2007/08 the average rate of graduation with a diploma for grade 12 students in high-poverty secondary schools was 68 percent, an 18 percentage-point drop from 1999/2000. By contrast, 86 percent of grade 12 White students in low-poverty secondary schools graduated with a diploma in 2007/08, unchanged from the rate in 1999/2000 (Aud et al. 2010).²

The consequences of not graduating from high school are well documented for students and society (for example, Kaplan, Damphousse, and Kaplan 1994; U.S. Bureau of the Census 2006; Rouse 2007; Muennig 2007; Cutler and Lleras-Muney 2008; Levin 2009). Nongraduates have lower lifetime earnings (Muennig 2007; U.S. Bureau of the Census 2006), poorer health (Cutler and Lleras-Muney 2006; Kaplan et al. 1994; Rouse 2007), and shorter life spans (Wong et al. 2002). High school dropouts are more likely to be unemployed, to receive public assistance (Muennig 2007), to commit crimes (Levin 2009), to have children at a

Early, accurate identification of at-risk students may support the development of effective, efficient intervention programs to boost graduation rates

younger age, and to be single parents (Kaufman, Alt, and Chapman 2004). Because of these consequences, states and school districts in the United States are under pressure to improve high school graduation rates, particularly for racial/ethnic minority students and students from disadvantaged

backgrounds (Balfanz et al. 2007; Klemick 2007).

Early, accurate identification of at-risk students may support the development of effective, efficient intervention programs to boost graduation rates (Hauser and Koenig 2011; Heppen and Therriault 2008; Jerald 2006, 2007). As states make strides in assembling longitudinal data systems, they are interested in developing indicators based on data from their student information systems that can be used to identify students who are at risk.³ Studies of middle school students in Philadelphia (Neild and Balfanz 2006; Neild and Farley 2004) and high school students in Chicago (Allensworth and Easton 2005, 2007) have shown that student outcomes and behaviors measured in middle school and early high school, including poor academic performance, low attendance, and lack of progression from one grade to the next, are correlated with the likelihood of not graduating on time. These academic and behavioral factors were also found to more accurately predict graduation than were student background characteristics (Allensworth and Easton 2007; Jerald 2006; Neild and Balfanz 2006). These findings suggest that states and school districts could incorporate indicators associated with dropping out into their data systems so that at-risk students could be identified while there is still time to intervene (Hauser and Koenig 2011).

The Consortium on Chicago School Research freshman on-track indicator

The current study focuses on an early warning indicator developed by the Consortium on Chicago School Research (CCSR), which takes into account grade 9 course credits and failures in core

courses. This freshman on-track indicator, based on research in the Chicago Public Schools district, considers a student to be on track at the end of the first year of high school if:

- The student has accumulated the necessary course credits in grade 9 to move to grade 10, as defined by district policy.
- The student has no more than one semester failure in any English, math, science, or social studies course.

A student who fails to meet either of these criteria is considered off track at the end of the first year of high school.

CCSR researchers found a relationship between graduation and course credits earned and number of course failures in freshman year (Allensworth and Easton 2005, 2007). The number of absences and grade point average were also found to be associated with graduation. The on-track indicator was based on credit accumulation and course failures because these are two key components required for graduation. A student who falls behind in freshman year credits will need to accelerate credit accumulation in subsequent years, increasing the difficulty of graduating on time. Likewise, a student who fails a course required for graduation will have to take the course again, possibly delaying graduation.

The CCSR found that the on-track indicator predicted graduation among Chicago Public Schools students. For students entering high school in 1999/2000, 81 percent of on-track students and 22 percent of off-track students graduated from high school within four years (Allensworth and Easton 2005). For students entering high school in 2000/2001, 82 percent of on-track students and 22 percent of off-track students graduated from high school within four years. A recent Regional Educational Laboratory (REL) Southwest study applied the CCSR indicator to five school districts in Texas and in all cases found a higher on-time graduation rate for students identified as on track than

for students identified as off track (Hartman et al. 2011). All these studies found that the on-track indicator predicted on-time graduation not only overall, but also for several student background subgroups, including racial/ethnic minority and economically disadvantaged students, who tend to have lower graduation rates.

These findings allow two possible interpretations. One is that the on-track indicator differentiates graduates from nongraduates because it reflects aspects of student background and prior academic experience that are themselves associated with graduating on time. For example, students who are low-achieving or from disadvantaged backgrounds might be more likely to be off track in their freshman year and to not graduate on time. Alternatively, the on-track indicator might predict student graduation over and above any association it has with student background and prior academic experience. That is, freshman credits and course failures may be related to graduation even after student background has been taken into account.

To see how the two interpretations applied to Chicago students, CCSR researchers examined the relationship between on-track status and on-time graduation while controlling for student gender, race/ethnicity, economic status, age, and prior assessment test scores. (Allensworth and Easton 2005, 2007). A relationship between the on-track indicator and on-time graduation remained even after student background characteristics were accounted for. The on-track indicator also predicted graduation for subgroups of students based on gender, race/ethnicity, economic background, and prior achievement. The current study uses a similar analysis to examine how the on-track indicator relates to on-time graduation, controlling for student background characteristics and prior assessment test scores.

Study motivation and research questions

Three Midwestern urban districts asked REL Midwest to explore the CCSR on-track indicator as one potential tool to identify students at risk of not

graduating on time (within four years).⁴ The current study provides information for two of these districts (referred to here as District A and District B), each with 30,000–40,000 students, on how well the on-track indicator differentiates students who graduated on time from those who did not.⁵

For the two freshman cohorts discussed in the CCSR reports (Allensworth and Easton 2005, 2007), the difference in on-time graduation rates between Chicago students identified as on track and those identified as off track in grade 9 was 59 percentage points for one cohort and 60 percentage points for the other. In the Texas school districts (Hartman et al. 2011), the difference ranged from 18.4 percentage points to 51.7 percentage points. The current study, by analyzing two more districts, will give educators access to an expanded repository of district-level studies to consider as they design local early warning systems. Educators can benefit from additional information about how consistently the CCSR on-track indicator predicts on-time graduation across districts with different characteristics.

The current study also examines how well the CCSR on-track indicator predicts on-time graduation when controlling for student background characteristics and prior achievement. The benefit of this analysis is that it provides additional information about how well the on-track indicator identifies students who do and do not graduate on time, regardless of certain student characteristics. Although CCSR found that the on-track indicator predicted graduation for Chicago students after accounting for student background variables, it is unknown whether this is the case in other districts.

The study addresses the following research questions:

- What were the freshman on-track and off-track rates for recent cohorts, overall and by student background subgroup?

The current study examines how well the on-track indicator predicts on-time graduation when controlling for student background characteristics and prior achievement

- How did four-year in-district graduation rates compare for on-track and off-track freshmen in recent cohorts, overall and by student background subgroup?
- To what extent does the on-track indicator predict four-year graduation rates for recent cohorts in each district, after accounting for baseline student background characteristics?

The study uses the CCSR method for calculating freshman on-track and off-track rates for the total student population and for specific student background subgroups. For the 2005/06 and 2006/07 cohorts, the study compares the on-time graduation rates for students identified as on track or off track at the end of their first year of high school. For these two cohorts, the relationship between on-track status and on-time graduation is also

analyzed, using a regression model that controls for student background variables that could be associated with graduating on time. The study data and methods are described further in box 1 and in appendix A.

STUDY FINDINGS

This section presents the findings by research question for two urban districts in the Midwest Region.

Freshman on-track and off-track graduation rates

District A. The share of freshmen who were on-track to graduate in the four cohorts in District A was highest in the 2005/06 cohort (51.5 percent) and decreased for each subsequent cohort, reaching 41.1 percent for the 2008/09 cohort (figure 1).

BOX 1

Study data and analysis

Data sources. Both districts provided student-level data for the 2005/06, 2006/07, 2007/08, and 2008/09 freshmen cohorts. District B also provided data for the 2009/10 freshman cohort. (These data were not available for District A.) The data files included the following information for each student: district entrance date and (if applicable) exit date and exit code, course records (including grades and credits earned), birth date, gender, race/ethnicity, individualized education program status, limited English proficiency status, free or reduced-price lunch status for District B (these data were not available for District A), and grade 8 scores and proficiency levels on state math and reading assessments.

Definitions of on-track and off-track status. Students were identified as on track at the end of their first

year of high school if they had accumulated the credits needed to be promoted to grade 10 as defined by district policy and if they had received no more than one failing grade in a semester in a core subject (English, math, science, or social studies). Students were identified as off track at the end of the first year of high school if they failed to meet either of these criteria.

Definition of on-time graduation status. Students in the 2005/06 and 2006/07 cohorts were classified as having graduated on time if district files identified them as having graduated on a date that was within four years of the date they began high school (see appendix B for more detail).

Analysis. For each cohort in each district included under the first research question on freshman on-track and off-track rates, the percentage of students who were on track and off track

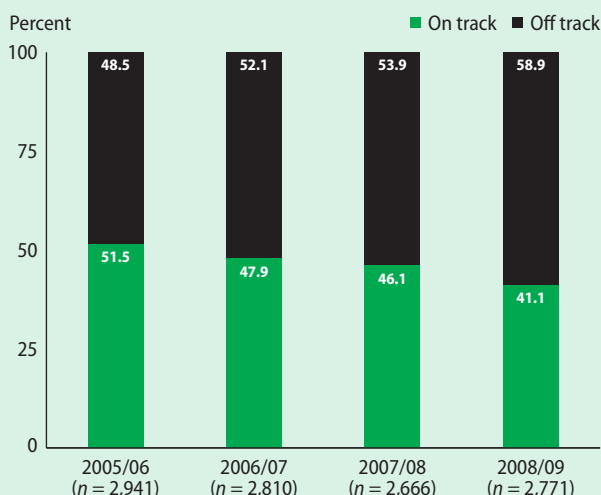
at the end of their first year of high school was calculated overall and for subgroups (gender, race/ethnicity, individualized education program status, age at the start of grade 9, and proficiency level on grade 8 math and reading assessments).

For the two cohorts in each district under the second research question on four-year in-district graduation rates, the percentage of on-track and off-track students who graduated within four years of starting high school was calculated overall and for the student subgroups.

For the two cohorts in each district under the third research question on how well the on-track indicator predicts four-year graduation rates, the relationship between the on-track indicator and the probability of student graduation was examined, controlling for student background characteristics and for grade 8 math and reading assessment scores.

FIGURE 1

Percentage of freshmen in the 2005/06–2008/09 cohorts in District A identified as on track or off track at the end of grade 9



Note: On-track and off-track rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06–2009/10 school years for whom on- or off-track status could be determined. Because of incomplete course records, on-track status could not be determined for some students in district A: 95 students in the 2005/06 cohort, 68 in the 2006/07 cohort, 95 in the 2007/08 cohort, and 89 in the 2008/09 cohort.

Source: Authors' analysis of student records provided by District A.

Figure 2 presents freshman on-track and off-track rates by student background subgroup. Differences in on-track rates were observed across classifications within each subgroup. For each cohort, on-track rates were higher for female students, White students, students without an individualized education program (IEP), students who were the traditional age of a high school freshman (age 14 or under at the start of freshman year), and students who met or exceeded proficiency on the state math or reading assessment in grade 8. As in the overall sample, the on-track rate for most subgroups was highest in the 2005/06 cohort and decreased in each subsequent cohort.

District B. The on-track rate in the five cohorts in District B ranged from 84.6 percent for the 2006/07 cohort to 86.9 percent for the 2009/10 cohort (figure 3). The rate did not consistently increase or decrease across cohorts.

Figure 4 presents freshman on-track and off-track rates by student background subgroup.

Differences in on-track rates were observed across classifications within each subgroup. For each cohort, on-track rates were higher for female students, White students, students without an IEP, students who were not eligible for free or reduced-price lunch, students who were the traditional age of a high school freshman (age 14 or under at the start of freshman year), and students who met or exceeded proficiency on the state math or reading assessment in grade 8. As in the overall sample, the on-track rate for most subgroups did not consistently increase or decrease across the cohorts. An exception was students who did not meet proficiency on the grade 8 state reading assessment; their on-track rate was highest in the 2005/06 cohort and decreased in each subsequent cohort.

Four-year in-district graduation rates for on-track and off-track freshmen

For both districts, the four-year graduation rate was calculated for on-track and off-track students in the 2005/06 and 2006/07 cohorts.

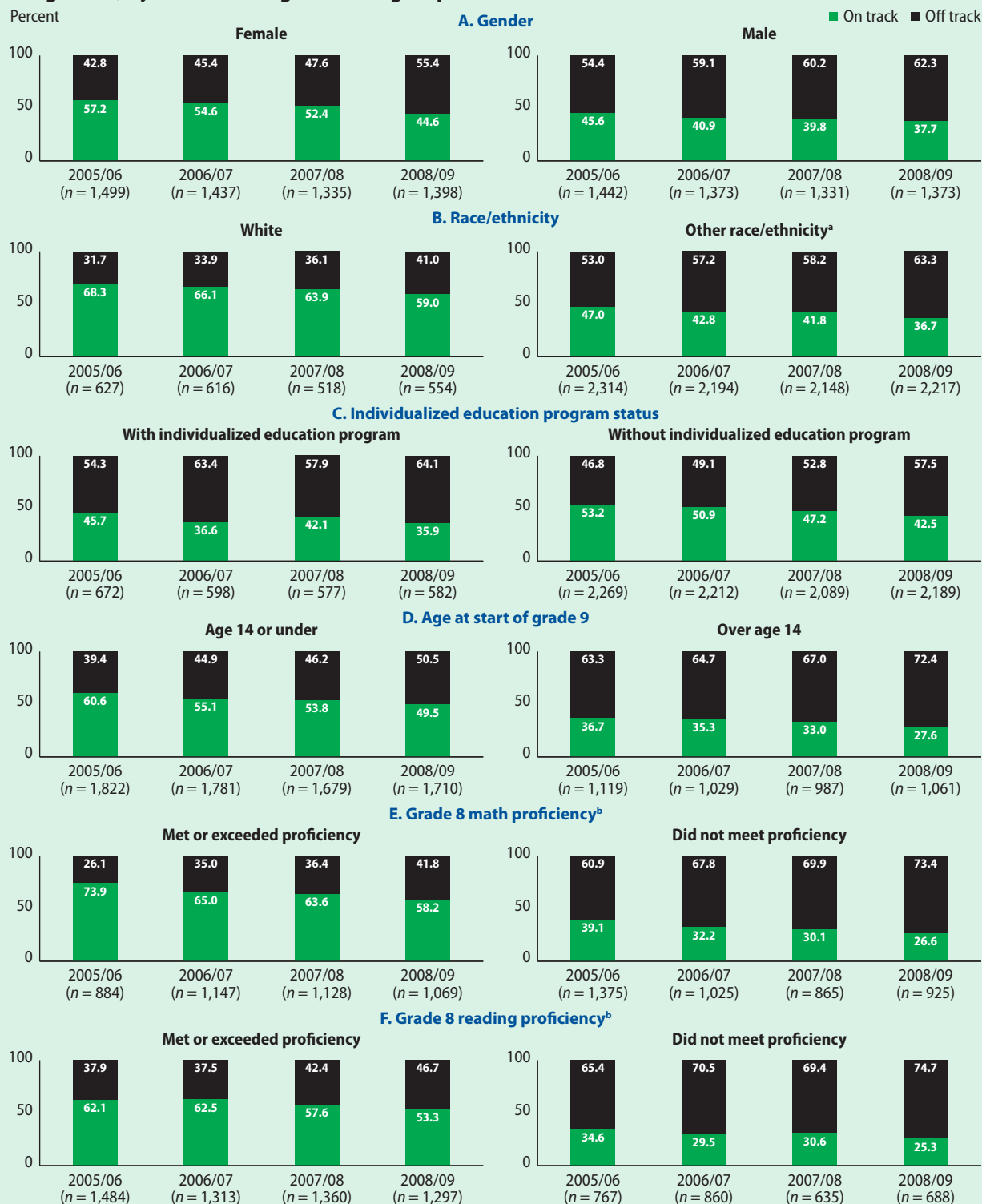
District A. In both cohorts, the four-year graduation rate for on-track students (79.8 percent in the 2005/06 cohort and 76.9 percent in the 2006/07 cohort) was approximately 2.5 times that for off-track students (29.9 percent in both the 2005/06 cohort and the 2006/07 cohort; figure 5).⁶

Within all subgroups, the on-time graduation rate was higher among students who were on track to graduate in four years than among students who were off track (figure 6). (See table D1 in appendix D for overall graduation rates for on-track and off-track students combined.)

Gender. For female students, the on-time graduation rate was 81.6 percent for on-track students and 34.1 percent for off-track students in the 2005/06 cohort and 78.4 percent and 34.8 percent in the 2006/07 cohort. For male students, the on-time graduation rate was 77.5 percent for on-track students and 26.4 percent for off-track students in the 2005/06 cohort and 74.8 percent and 25.9 percent in the 2006/07 cohort.

FIGURE 2

Percentage of freshmen in the 2005/06–2008/09 cohorts in District A identified as on track or off track at the end of grade 9, by student background subgroup



Note: On-track and off-track rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06–2009/10 school years for whom on- or off-track status could be determined. Data were not available to create subgroups based on free or reduced-price lunch status.

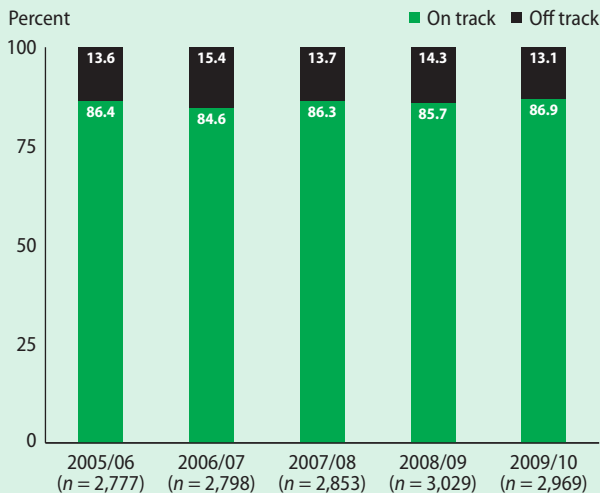
a. Includes Asian, Black, Hispanic, Native American, and multiracial students, who were grouped into a single category because of the small numbers of non-Black minority students.

b. Students with missing assessment scores were not included in the calculations for math and reading proficiency levels. The state classifies assessment scores into five proficiency categories. The proficient category and two above-proficient categories were combined to create the “met or exceeded proficiency” category; two below-proficient categories were combined to create the “did not meet proficiency” category.

Source: Authors’ analysis of student records provided by District A.

FIGURE 3

Percentage of freshmen in the 2005/06–2009/10 cohorts in District B identified as on track or off track at the end of grade 9



Note: On-track and off-track rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06–2009/10 school years for whom on- or off-track status could be determined. Because of incomplete course records, on-track status could not be determined for some students in District B: 106 students in the 2005/06 cohort, 102 in the 2006/07 cohort, 105 in the 2007/08 cohort, 79 in the 2008/09 cohort, and 76 in the 2009/10 cohort.

Source: Authors' analysis of student records provided by District B.

Race/ethnicity. For White students, the on-time graduation rate was 86.0 percent for on-track students and 29.3 percent for off-track students in the 2005/06 cohort and 82.1 percent and 28.7 percent in the 2006/07 cohort. For students in the other race/ethnicity subgroup, the on-time graduation rate was 77.4 percent for on-track students and 30.0 percent for off-track students in the 2005/06 cohort and 74.6 percent and 30.1 percent in the 2006/07 cohort.

Individualized education program status. For students with an IEP, the on-time graduation rate was 70.9 percent for on-track students and 28.2 percent for off-track students in the 2005/06 cohort and 61.7 percent and 28.4 percent in the 2006/07 cohort. For students without an IEP, the on-time graduation rate was 82.1 percent for on-track students and 30.5 percent for off-track students in the 2005/06 cohort and 79.7 percent and 30.4 percent in the 2006/07 cohort.

Age. For grade 9 students who were the typical age of a high school freshman (age 14 or under at the

start of grade 9), the on-time graduation rate was 83.6 percent for on-track students and 37.2 percent for off-track students in the 2005/06 cohort and 81.7 percent and 37.7 percent in the 2006/07 cohort. For students who were older than the typical high school freshman (over age 14 at the start of grade 9), the on-time graduation rate was 68.9 percent for on-track students and 22.2 percent for off-track students in the 2005/06 cohort and 63.4 percent and 19.9 percent in the 2006/07 cohort.

Grade 8 math proficiency. For students who met or exceeded proficiency on the grade 8 math assessment, the on-time graduation rate was 90.2 percent for on-track students and 49.8 percent for off-track students in the 2005/06 cohort and 85.9 percent and 39.2 percent in the 2006/07 cohort. For students who did not meet proficiency on the grade 8 math assessment, the on-time graduation rate was 72.4 percent for on-track students and 27.3 percent for off-track students in the 2005/06 cohort and 62.6 percent and 24.7 percent in the 2006/07 cohort.

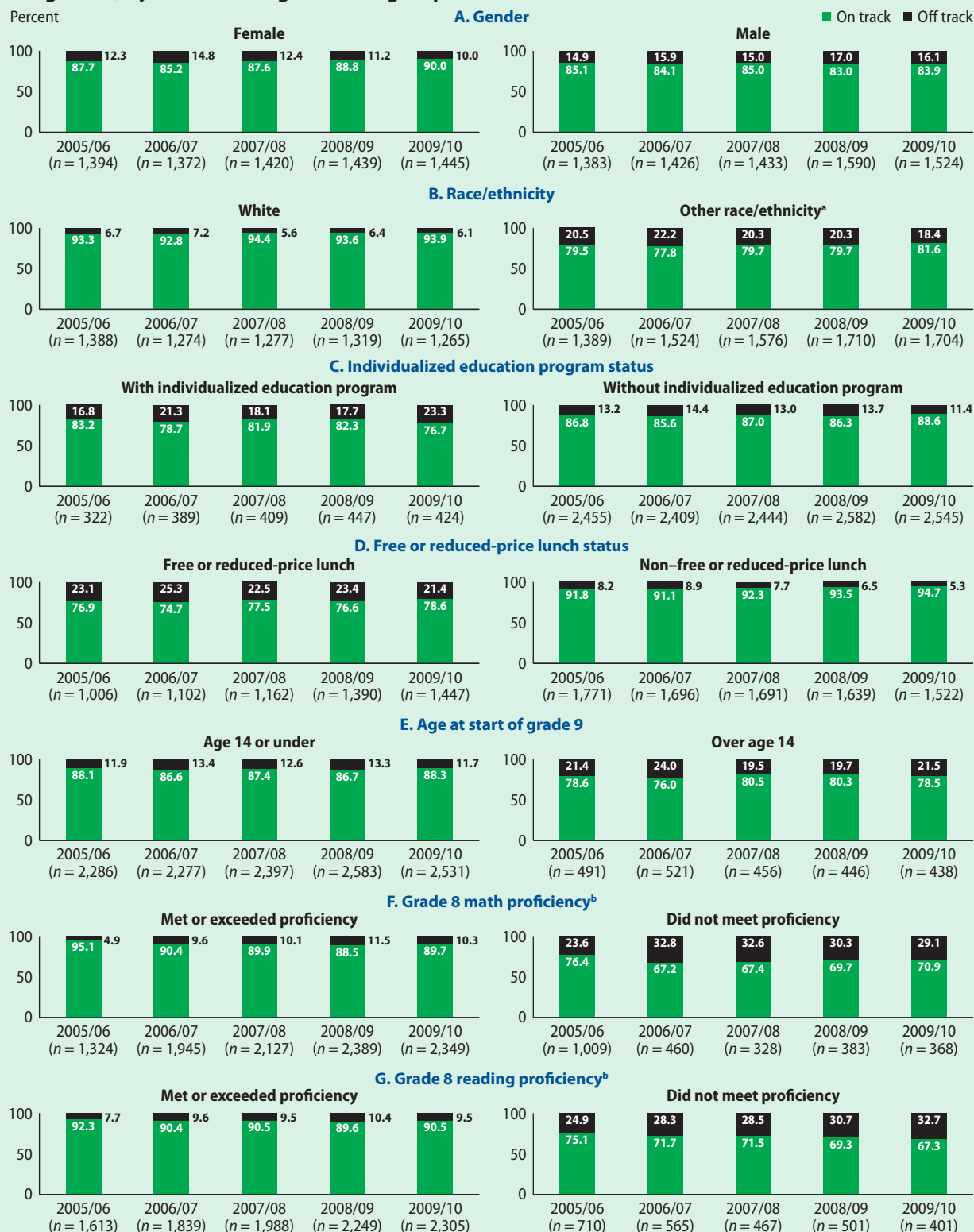
Grade 8 reading proficiency. For students who met or exceeded proficiency on the grade 8 reading assessment, the on-time graduation rate was 86.3 percent for on-track students and 39.4 percent for off-track students in the 2005/06 cohort and 84.3 percent and 40.1 percent in the 2006/07 cohort. For students who did not meet proficiency on the grade 8 reading assessment, the on-time graduation rate was 69.3 percent for on-track students and 23.8 percent for off-track students in the 2005/06 cohort and 61.4 percent and 21.6 percent in the 2006/07 cohort.

District B. In both cohorts, the four-year graduation rate for on-track students (90.6 percent in the 2005/06 cohort and 90.5 percent in the 2006/07 cohort) was nearly twice the rate for off-track students (46.1 percent in the 2005/06 cohort and 44.7 percent in the 2006/07 cohort; figure 7).^{7,8}

Within all student background subgroups, on-time graduation rates were higher among students who were on track to graduate in four years than

FIGURE 4

Percentage of freshmen in the 2005/06–2009/10 cohorts in District B identified as on track or off track at the end of grade 9, by student background subgroup



Note: On-track and off-track rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06–2009/10 school years for whom on- or off-track status could be determined.

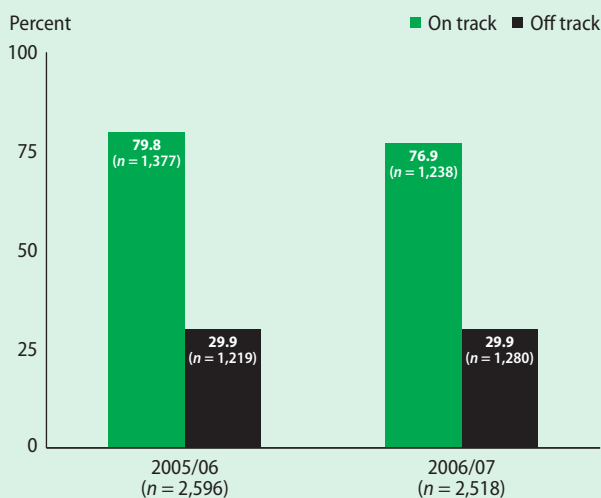
a. Includes Asian, Black, Hispanic, Native American, and multiracial students, who were grouped into a single category because of the small numbers of non-Black minority students.

b. Students with missing assessment scores were not included in the calculations for math and reading proficiency levels. The state classifies assessment scores into five proficiency categories. The proficient category and two above-proficient categories were combined to create the “met or exceeded proficiency” category; two below-proficient categories were combined to create the “did not meet proficiency” category.

Source: Authors’ of student records provided by District B.

FIGURE 5

Percentage of on-track and off-track freshmen in the 2005/06 and 2006/07 cohorts in District A who graduated within four years



Note: Graduation rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06 and 2006/07 academic years for whom on- or off-track status could be determined. Not included in these calculations were grade 9 students who died, transferred out of the district, or moved out of the United States in grades 10–12 and students who transferred into the district after grade 9.

Source: Authors' analysis of student records provided by District A.

among students who were off track (figure 8). For on-track students, graduation rates ranged from 78.0 percent to 95.8 percent, depending on student subgroup. For off-track students, graduation rates ranged from 28.6 percent to 63.6 percent. (See table D2 in appendix D for overall graduation rates for on-track and off-track students combined.)

Gender. For female students, the on-time graduation rate was 92.0 percent for on-track students and 54.0 percent for off-track students in the 2005/06 cohort and 92.5 percent and 53.6 percent in the 2006/07 cohort. For male students, the on-time graduation rate was 89.2 percent for on-track students and 39.4 percent for off-track students in the 2005/06 cohort and 88.6 percent and 35.8 percent in the 2006/07 cohort.

Race/ethnicity. For White students, the on-time graduation rate was 95.8 percent for on-track students and 52.7 percent for off-track students in the 2005/06 cohort and 94.5 percent and 52.2 percent

in the 2006/07 cohort. For students in the other race/ethnicity subgroup, the on-time graduation rate was 84.3 percent for on-track students and 44.9 percent for off-track students in the 2005/06 cohort and 86.4 percent and 43.4 percent in the 2006/07 cohort.

IEP status. For students with an IEP, the on-time graduation rate was 80.6 percent for on-track students and 44.4 percent for off-track students in the 2005/06 cohort and 80.2 percent and 47.0 percent in the 2006/07 cohort. For students without an IEP, the on-time graduation rate was 91.8 percent for on-track students and 46.4 percent for off-track students in the 2005/06 cohort and 91.9 percent and 44.2 percent in the 2006/07 cohort.

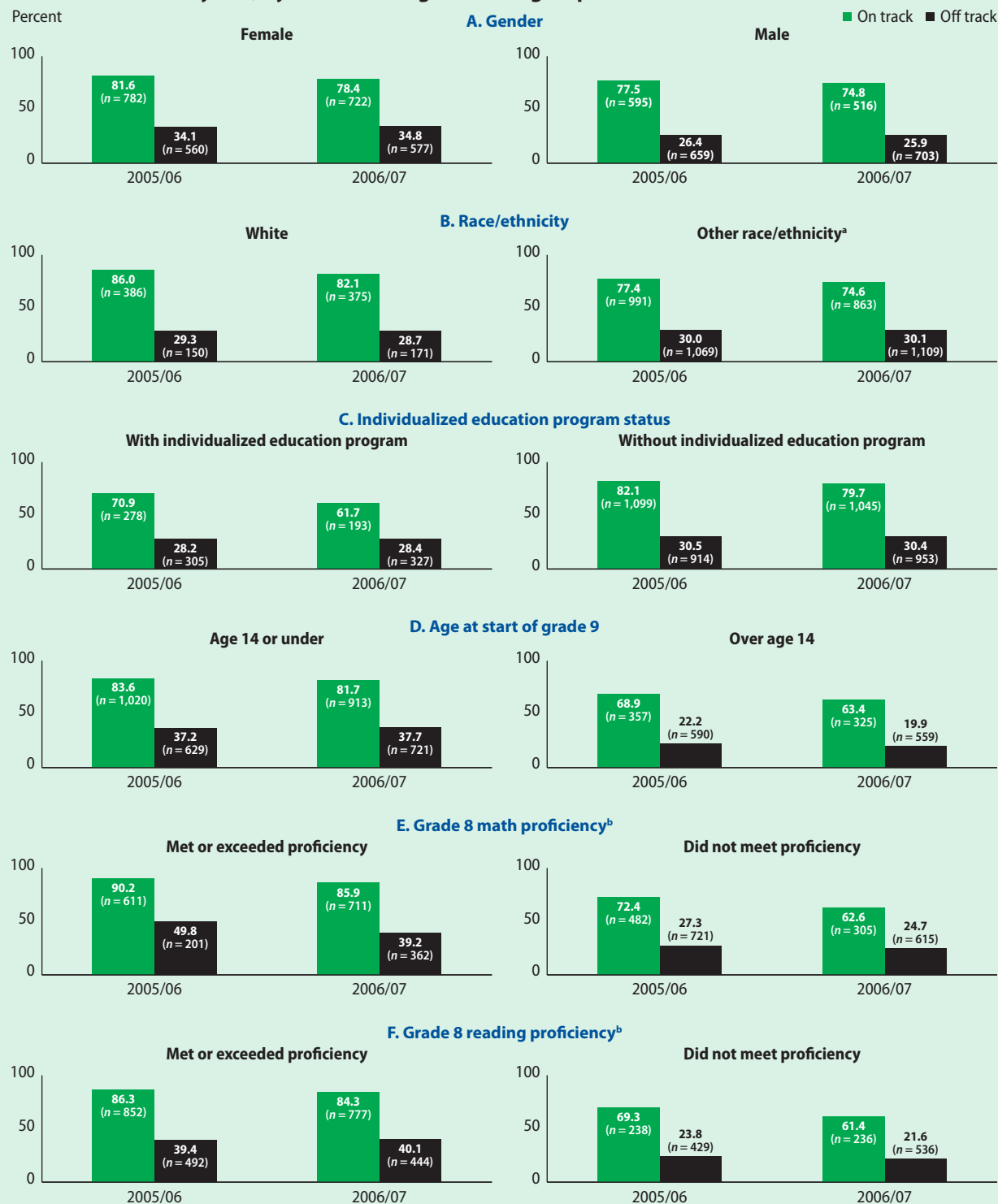
Free or reduced-price lunch status. For students receiving free or reduced-price lunch, the on-time graduation rate was 80.9 percent for on-track students and 38.5 percent for off-track students in the 2005/06 cohort and 82.7 percent and 38.0 percent for off-track students in the 2006/07 cohort. For students not receiving free or reduced-price lunch, the on-time graduation rate was 94.9 percent for on-track students and 57.6 percent for off-track students in the 2005/06 cohort and 94.4 percent and 57.4 percent in the 2006/07 cohort.

Age. For grade 9 students who were the age of typical high school freshmen (age 14 or under at the start of grade 9), the on-time graduation rate was 92.6 percent for on-track students and 53.1 percent for off-track students in the 2005/06 cohort and 91.5 percent and 49.6 percent in the 2006/07 cohort. For students who were older than the age of typical high school freshmen (over age 14 at the start of grade 9), the on-time graduation rate was 80.2 percent for on-track students and 28.6 percent of off-track students in the 2005/06 cohort and 85.6 percent and 32.3 percent in the 2006/07 cohort.

Grade 8 math proficiency. For students who met or exceeded proficiency on the grade 8 state math assessment, the on-time graduation rate was 95.8

FIGURE 6

Percentage of on-track and off-track freshmen in the 2005/06 and 2006/07 cohorts in District A who graduated within four years, by student background subgroup



Note: Graduation rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06 and 2006/07 academic years for whom on- or off-track status could be determined. Grade 9 students who died, transferred out of the district, or moved out of the United States in grades 10–12 and students who transferred into the district after grade 9 were not included in graduation calculations.

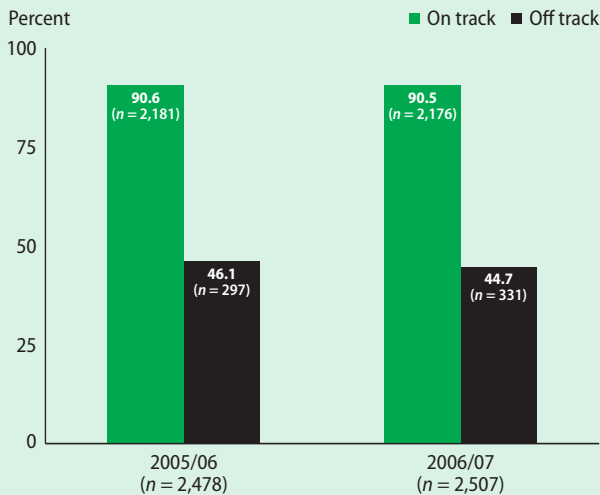
a. Includes Asian, Black, Hispanic, Native American, and multiracial students, who were grouped into a single category because of the small numbers of non-Black minority students.

b. Students with missing assessment scores were not included in the calculations for math and reading proficiency levels. The state classifies assessment scores into five proficiency categories. The proficient category and two above-proficient categories were combined to create the “met or exceeded proficiency” category; two below-proficient categories were combined to create the “did not meet proficiency” category.

Source: Authors’ analysis of student records provided by District A.

FIGURE 7

Percentage of on-track and off-track freshmen in the 2005/06 and 2006/07 cohorts in District B who graduated within four years



Note: Graduation rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06 and 2006/07 academic years for whom on- or off-track status could be determined. Not included in these calculations were grade 9 students who died, transferred out of the district, or moved out of the United States in grades 10–12 and students who transferred into the district after grade 9.

Source: Authors' analysis of student records provided by District B.

percent for on-track students and 63.6 percent for off-track students in the 2005/06 cohort and 93.1 percent and 52.9 percent in the 2006/07 cohort. For students who did not meet proficiency on the grade 8 math assessment, the on-time graduation rate was 84.6 percent for on-track students and 41.5 percent for off-track students in the 2005/06 cohort and 78.0 percent and 40.9 percent in the 2006/07 cohort.

Grade 8 reading proficiency. For students who met or exceeded proficiency on the grade 8 state reading assessment, the on-time graduation rate was 94.7 percent for on-track students and 50.5 percent for off-track students in the 2005/06 cohort and 93.7 percent and 52.6 percent in the 2006/07 cohort. For students who did not meet proficiency on the grade 8 reading assessment, the on-time graduation rate was 83.3 percent for on-track students and 43.2 percent for off-track students in the 2005/06 cohort and 79.3 percent and 41.5 percent in the 2006/07 cohort.

Using the on-track indicator to predict four-year graduation rates

The on-track indicator was a statistically significant predictor of on-time graduation, even after taking into account differences in students' gender, race/ethnicity, IEP status, free or reduced-price lunch status (District B only), age, grade 8 assessment test scores, and cohort. The full results are presented in appendix E.

For District A, students who were on track to graduate at the end of their freshman year were 6.6 times more likely to graduate than were students with similar characteristics who were off track at the end of their freshman year. For District B, students who were on track at the end of their freshman year were 5.5 times more likely to graduate than were students with similar characteristics who were off track at the end of their freshman year.

For both districts, the effect size, as measured by the changes in odds, was bigger for on-track status than for any student background characteristic or for grade 8 assessment scores.⁹ This means that being on track to graduate at the end of freshman year is more predictive of a student graduating than racial/ethnic minority status, IEP status, or free or reduced-price lunch status.

HOW THESE RESULTS COMPARE WITH THOSE OF OTHER STUDIES

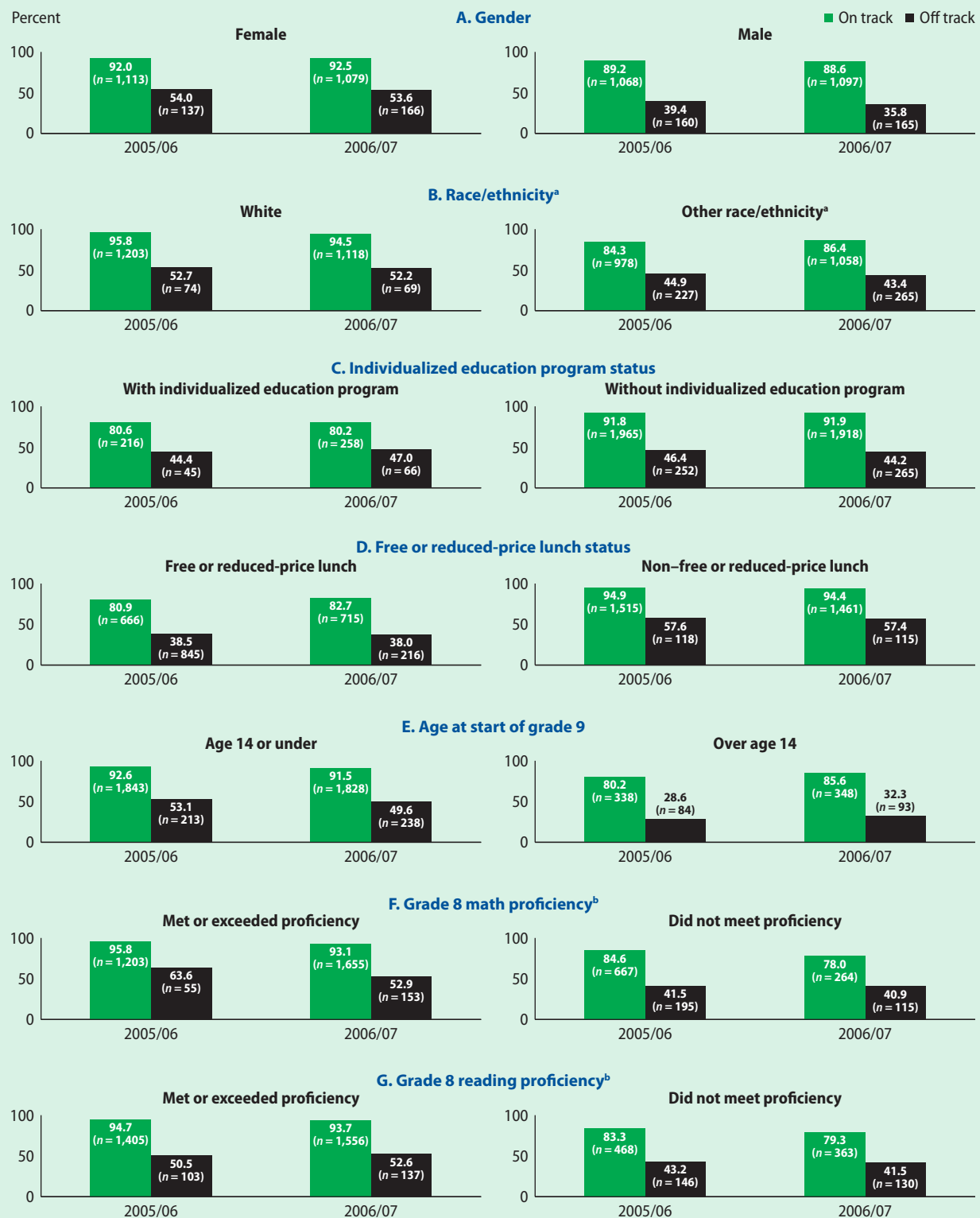
This section compares the results of this study with the findings reported in CCSR's studies of Chicago students (Allensworth and Easton 2005, 2007) and in REL Southwest's study of five Texas districts (Hartman et al. 2011). All three studies used methods similar to the ones used in the current study.

On-track rates

The on-track graduation rates found in the current study are higher than those reported in the first

FIGURE 8

Percentage of on-track and off-track freshmen in the 2005/06 and 2006/07 cohorts in District B who graduated within four years, by subgroup



Note: Graduation rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06 and 2006/07 academic years for whom on- or off-track status could be determined. Grade 9 students who died, transferred out of the district, or moved out of the United States in grades 10–12 and students who transferred into the district after grade 9 were not included in graduation calculations.

a. Includes Asian, Black, Hispanic, Native American, and multiracial students, who were grouped into a single category because of the small numbers of non-Black minority students.

b. Students with missing assessment scores were not included in the calculations for math and reading proficiency levels. The state classifies assessment scores into five proficiency categories. The proficient category and two above-proficient categories were combined to create the “met or exceeded proficiency” category; two below-proficient categories were combined to create the “did not meet proficiency” category.

Source: Authors’ analysis of student records provided by District B.

CCSR report (Allensworth and Easton 2005) and in all but one of the five Texas districts examined by REL Southwest (Hartman et al. 2011). In District A, the proportion of first-time grade 9 students classified as on track for high school graduation within four years ranged from 41.1 percent in the 2008/09 cohort to 51.5 percent in the 2005/06 cohort. In District B, the proportion of first-time grade 9 students classified as on track for on-time high school graduation ranged from 84.6 percent in the 2006/07 cohort to 86.9 percent in the 2009/10 cohort. For Chicago students in the 1994/95–2003/04 freshman cohorts, the on-track rate ranged from 50 percent to 66 percent (Allensworth and Easton 2005). For five Texas districts, the on-track rate ranged from 61.2 percent to 86 percent.

In both districts, the on-track rate was higher for female students than for male students; for White students than for students of other race/ethnicity; for students with an IEP than for those without; for students who did not receive free or reduced-price lunch than for those who did (examined in District B only); for students who were age 14 or under at the start of freshman year than for those who were over age 14; and for students who met proficiency on grade 8 state math and reading assessments than for those who did not. These findings are consistent with those of the other two studies.

Graduation rates for on-track and off-track students

As in the CCSR and REL Southwest studies, in this study on-track students graduated on time at a higher rate than did off-track students, both overall and within all student subgroups. In District A, the average on-time graduation rate for first-time freshmen who were on track at the end of grade 9 was 2.6 times higher than the rate for students who were off track. In District B, the average on-time graduation rate for first-time freshmen who were on track at the end of grade 9 was 2.0 times higher than the rate for those who were off track.

The difference in the graduation rate between on-track and off-track students was smaller in both

Districts A and B than for the Chicago students in the CCSR study. The graduation rate for Chicago students was 3.7 times higher for on-track students than for off-track students in both the 1999/2000 cohort (Allensworth and Easton 2005) and the 2000/01 cohort (Allensworth and Easton 2007). In the five Texas districts examined by REL Southwest, the on-time graduation rate was 1.4–3.5 times higher for on-track students than for off-track students.

The on-track graduation rates found in the current study are higher than those reported in two studies that use a similar methodology

The utility of an on-track indicator depends largely on how well it predicts on-time graduation. The less accurately the indicator predicts on-time graduation for on-track students, the greater the risk of identifying as on track students who need intervention. The less accurately the indicator predicts on-time graduation for off-track students, the greater the risk of targeting interventions to students who are not in need of intervention.

The accuracy with which the on-track indicator predicts on-time graduation varied among the eight districts examined in the CCSR study, the REL Southwest study, and this study. For on-track students, the graduation rate in these districts ranged from 70 percent to 91 percent. For off-track students, the graduation rate ranged from 20 percent to 51 percent.

In the current study, an average of 78 percent of on-track students in District A and 91 percent in District B graduated on-time, and 39 percent of off-track students in District A and 45 percent in District B graduated on-time. In the hypothetical situation that both districts had used the CCSR on-track indicator to target interventions to off-track students in the cohorts examined, District B would have had a higher proportion of off-track students who graduated on time and thus might have been more likely to devote resources to students not at risk. District A would have had a higher proportion of on-track students who did

The findings suggest that freshman year academic performance is associated with graduation, over and above student background and prior achievement

not graduate in four years and would have been more likely to fail to identify students at risk.

It would benefit districts to consider the potential accuracy of the CCSR on-track indicator and other early warning indicators before adopting them as measures to identify students at risk

of not graduating on time. Future research could explore whether a more accurate indicator or set of indicators for predicting graduation, such as student attendance and study behaviors, could be developed for districts similar to the two districts in this study.

The relationship between on-track status and on-time graduation

For students in the 2005/06 and 2006/07 cohorts, on-track status at the end of grade 9 was statistically significantly associated with graduation, after controlling for student gender, race/ethnicity, IEP status, age, and math and reading assessment scores. Similar results were found in the CCSR studies. These findings are inconsistent with the argument that the on-track indicator predicts graduation only because it reflects certain aspects of student background. Rather, these findings suggest that freshman year academic performance is associated with graduation, over and above student background and prior achievement.

LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FUTURE RESEARCH

Findings for other districts might not be the same as those from this study, whose results should be considered in light of several limitations.

First, the regression models in this study used a limited set of indicators to control for student characteristics. If other student indicators were used, the strength of the relationship between

on-track status and on-time graduation would likely differ.

Second, differences between the two districts mean that the findings for each must be interpreted independently. The two districts have different policies for tracking students who have left the district, and calculated graduation rates may be more accurate in one district than the other (see appendix C). The regression models for each district included different student background variables, which limits comparability across districts. It may not be appropriate to compare findings from this study with similar research in other districts, because the findings might be limited by differences in district policies, practices, and aspects of student background examined.

Third, students with missing assessment scores were not included in the regression models. Although these students were similar in background characteristics examined to the students who were included,¹⁰ they might have differed on other characteristics that were not measured.

Fourth, this study was limited to examination of the four-year graduation rate, defined by whether a student has completed all high school requirements by the end of the fourth year of high school. It is not known whether the on-track indicator would predict graduation in more than four years as reliably as it predicts four-year graduation.¹¹

Future research might examine this relationship in districts that differ in geographic locale and student body characteristics. The CCSR on-track indicator has not yet been studied in rural or suburban districts. Future research using school-level variables might reveal variations across schools in this relationship. In the CCSR study of Chicago students (Allensworth and Easton 2005), both on-track and graduation rates varied across schools with similar student bodies. Finally, future studies could compare the on-track indicator with other early warning indicators or explore how the indicator might be integrated into early warning systems that include multiple indicators.

APPENDIX A STUDY DATA AND ANALYSIS

This appendix describes the study data and methodology.

Data sources

Both districts in this study provided student-level data for the freshman cohorts of 2005/06, 2006/07, 2007/08, and 2008/09. District B also provided data for the 2009/10 freshman cohort; data for the 2009/10 cohort were not available from District A.

The data files included the following information for each student: district entry date and (if applicable) exit date and exit code, course records (including grades and credits earned), birth date, gender, race/ethnicity, individualized education program (IEP) status, limited English proficiency (LEP) status, and grade 8 scores and proficiency levels on state math and reading assessments. Because analyses excluded repeat freshmen (grade 9 students whose unique identifier number was found in the grade 9 roster file of a previous school year), the districts also provided student roster data for the 2004/05 freshman cohort so that repeat freshmen in 2005/06 could be identified. Repeat freshmen were excluded because the Chicago Consortium for School Research (CCSR) on-track indicator is based on research on first-time freshmen. For the 2005/06 and 2006/07 cohorts, the district files included graduation data and information on student withdrawals over the course of high school. District B files also indicated whether each student received free or reduced-price lunch during grade 9. (These data were not made available for District A.) To protect student privacy, an encrypted identifier was used to match students across data files.

Definitions of on-track and off-track status. Students were identified as on track if they met the following two criteria by the end of grade 9:

- They had accumulated the number of credits needed for promotion to grade 10, as defined by district policy.

- They had received no more than one failing grade for a semester in a core subject (English, math, science, or social studies).

Students were identified as off track at the end of the first year of high school if either of these criteria was not met.

Definition of on-time graduation status. Students in the 2005/06 and 2006/07 cohorts were classified as having graduated on time if district files identified them as having graduated on a date that was within four years of the date they entered grade 9. Additional information appears in appendix B.

Analytic samples

An analytic sample was constructed for each research question. For the first question, which addresses freshman on-track and off-track rates, the analytic sample for each cohort included all students enrolled in the district at the end of their first freshman year, with the exception of students with missing or problematic enrollment data and students for whom only one semester of course data was available. (On-track status could not be determined for these students.) For the second research question, which addresses graduation rates by freshman on-track status, students were excluded from the sample if they had died, moved outside the United States, or transferred out of the district to another school district, a state-approved alternative education program, or home school. It is unknown whether these students graduated on time.

For the third research question, which addresses the extent to which the on-track indicator predicts graduation after controlling for student background variables, additional students were excluded from the sample if their grade 8 math or reading assessment test score was not available.

The analytic samples were similar across research questions and cohorts in the distribution of student characteristics. Appendix C includes detailed information on the construction of the analytic

samples and the distribution of student characteristics across those samples.

Analysis

For the first research questions, the percentages of students who were on track and off track at the end of their first year of high school were calculated for each of the four or five cohorts in each district. These percentages were calculated overall and for student background subgroups based on gender, race/ethnicity, IEP status, age at the start of grade 9, and proficiency level on grade 8 math and reading assessments. The number of students in some subgroups was small enough to risk disclosing the identities of the sample districts and to produce potentially misleading results (such as oscillations in on-track rates across cohorts that might be interpreted as large but that were attributable to a small number of students). For these reasons, student data on English language learner status were not analyzed, and all racial/ethnic

minority students were included in one “other race/ethnicity” subgroup instead of analyzing each racial/ethnic subgroup separately.

For the two cohorts in each district included in the second research question, the percentages of on-track and off-track students who graduated within four years of starting high school were calculated overall and for student background subgroups.

For the two cohorts in each district studied for the third research question, the relationship between the on-track indicator and the probability of student graduation was examined, controlling for student background characteristics and for grade 8 math and reading assessment scores. A hierarchical logistic model was used for the analysis, which was appropriate because of the binary outcome (graduated on time or did not graduate on time) and because of the hierarchical structure of the data, with students nested in schools. Details on the model specifications are in appendix E.

APPENDIX B
DETERMINATION OF ON-TRACK STATUS
AND GRADUATION STATUS

On-track status and on-time graduation were determined using the Chicago Consortium for School Research (CCSR)'s methodology (see Allensworth and Easton 2005).

Determining on-track status

Student data files contained information on the courses for which students were registered, the semester when each course was taken, the letter grade earned for each course, and the number of credits earned for each course. Students were classified as on track if, during their first year of high school, they had earned enough course credits to be promoted to grade 10 and if they earned

no more than one semester F in a core subject (English, math, science, or social studies). District A required five full-year credits to be promoted to grade 10. District B required four full-year credits to be promoted for the 2005/06, 2006/07, and 2007/08 cohorts and five full-year credits for the 2008/09 and 2009/10 cohorts.

Determining on-time graduation

Students were identified as graduates if the district files included a graduation date for them. They were identified as on-time graduates if the graduation date was no more than four years from the start of grade 9. Neither district recognizes individuals earning a General Educational Development (GED) diploma as high school graduates. GED information was not included in the district files.

APPENDIX C

ANALYTIC SAMPLES

Building the analytic samples

This appendix describes how the analytic samples were created for each research question and compares the distribution of student characteristics across analytic samples.

The steps followed to exclude students from the analytic sample for each of the three research questions are presented in tables C1 (District A) and C2 (District B). For each cohort, the tables present the number of students excluded in each

TABLE C1

Analytic sample exclusions for each cohort of students in District A

Reason for exclusion		2005/06	2006/07	2007/08	2008/09
Total number of grade 9 students in the district file		4,452	4,556	4,209	4,295
Step 1	Students who were not enrolled at the end of grade 9	818	991	431	374
Step 2	Students with missing or problematic enrollment data	19	12	0	0
Step 3	Repeat freshmen	579	675	1,017	1,061
Step 4	Students for whom on-track or off-track status could not be determined at the end of grade 9	95	68	95	89
Remaining sample: number of students included in analysis for research question 1		2,941	2,810	2,666	2,771
Step 5	Students who died, moved out of the United States, or transferred out of the district in grades 10–12	344	292	na	na
Remaining sample: number of students included in analysis for research question 2		2,596	2,518	na	na
Step 6	Students with missing grade 8 assessment test data ^a	591	529	na	na
Remaining sample: number of students included in analysis for research question 3 (hierarchical linear model analysis)		2,005	1,989	na	na

na is not applicable: freshmen in these cohorts had not yet completed four years of high school and so were not included in the analysis for the first two research questions.

a. In the hierarchical linear model analysis, students with missing data were dropped casewise.

Source: Authors' analysis of student records provided by District A.

TABLE C2

Analytic sample exclusions for each cohort of students in District B

Reason for exclusion		2005/06	2006/07	2007/08	2008/09	2009/10
Total number of grade 9 students in the district file		3,340	3,452	3,415	3,685	3,487
Step 1	Students who were not enrolled at the end of freshman year	321	359	308	483	319
Step 2	Students with missing or problematic enrollment data	59	59	24	0	3
Step 3	Repeat freshmen	74	134	125	94	120
Step 4	Students for whom on- or off-track status could not be determined at the end of grade 9	109	102	105	79	76
Remaining sample: number of students included in analysis for research question 1		2,777	2,798	2,853	3,029	2,969
Step 5	Students who died, moved out of the United States, or transferred out of the district in grades 10–12	299	291	na	na	na
Remaining sample: number of students included in analysis for research question 2		2,478	2,507	na	na	na
Step 6	Students with missing grade 8 assessment test data ^a	360	322	na	na	na
Remaining sample: number of students included in analysis for research question 3 (hierarchical linear model analysis)		2,118	2,185	na	na	na

na is not applicable: freshmen in these cohorts had not yet completed four years of high school and so were not included in the analysis for the first two research questions.

a. In the hierarchical linear model analysis, students with missing data were dropped casewise.

Source: Authors' analysis of student records provided by District B.

step and the number of students in the final analytic sample.

Research Question 1 samples

The data files received from the districts included all students who enrolled in grade 9 at any point and for any length of time during the 2005/06–2008/09 academic years for District A and the 2005/06–2009/10 academic years for District B. Based on input from the districts and in keeping with the sample decisions made in prior studies (Allensworth and Easton 2005; Hartman et al. 2011), the following students were excluded from the analytic samples for research question 1: students who were not enrolled at the end of freshman year (step 1), students for whom enrollment status could not be confirmed because of missing data (step 2), and students who were repeat freshmen (step 3). Consistent with Hartman et al. (2011), students enrolled at the end of grade 9 for whom on-track status could not be determined because of incomplete course records were also excluded.

Step 1

District A. To identify students in District A who had left the district in grade 9, students whose second semester course records were missing were identified. (Leave dates alone were not reliable indicators of whether a student had left the district during grade 9: some students with leave dates in grade 9 had left the district and returned before the end of grade 9, and dates of re-entry were not noted in the district files.) To verify that students with missing second semester course data had left the district, the study team examined whether any leave code had been assigned to them by the district. Across the five cohorts, 80–90 percent of these students had leave codes assigned to them. The remaining 10–20 percent had no grade 9 leave codes. However, the group without leave codes was similar to the group with leave codes in that less than 5 percent of these students were enrolled in the district in grade 12. This suggests, if indirectly, that students missing grade 9 second semester course records had left the district, whether leave

codes had been assigned to them or not. Based on this analysis, all students without grade 9 second semester course grades were classified as “not enrolled at the end of freshman year,” and these students were removed from the analytic sample.

District B. For District B, all students who had a leave code indicating that they had left the district and who had a leave date before the end of their freshman year were classified as “not enrolled at the end of freshman year” and removed from the analytic sample. Leave codes and dates were crosschecked with student course records to verify that no second semester course data were available for these students.

Step 2. For both districts, there were students in each cohort whose birthdates, entry dates, or leave dates suggested that they might not have been freshmen in the district and cohort in which they were included. Examples included having a birthdate indicating that the student was not yet of school age or having a district entry date after the end of grade 9. These students were removed from the analytic sample, as were students whose birthdates, entry dates, and leave dates were all missing.

Step 3. For both districts, repeat freshmen were identified by comparing the grade 9 student roster for each cohort with the grade 9 roster for the previous year. If a student identifier number appeared in both rosters, the student was classified as a repeat freshman and excluded from the sample.

Step 4. For both districts, students missing grade 9 first semester course data were excluded from the sample.

Research question 2 samples

The exclusions to the analytic samples for research question 2 (steps 5–7) are consistent with Hartman et al. (2011).

Step 5. For both districts, graduation rate calculations excluded students whose leave code indicated that they had died in grades 10–12.

For both districts, graduation rate calculations excluded students whose leave code indicated that they moved out of the United States in grades 10–12. These students may or may not have graduated on time.

For both districts, graduation rate calculations excluded students whose leave code indicated that they had transferred to another district or an approved alternative education program in grades 10–12. These students may or may not have graduated on time.

District A classifies students as having transferred to another educational setting only if a transcript request from the new school or district was on file. Because District B does not have a similar method for confirming student transfers, it is possible that some District B students excluded in step 6 did not transfer but dropped out. If so, the District B graduation rates calculated in this study might be higher than actual graduation rates. Representatives of District B acknowledged this possibility but maintained that student leave codes are nevertheless the best gauge of whether students transferred to another educational setting.

Research question 3 sample

Step 6. The hierarchical logistic regression analysis used to address research question 3 used casewise deletion to drop students with missing data.¹² For

both districts, the only variables with missing data were math and reading assessment test scores.

One concern related to the casewise deletion of students with missing assessment test scores was the large number of students dropped from the analysis for this reason (shown in the row labeled step 7 in tables C1 and C2). To see the effect of these exclusions, the results from the final model (appendix E) were compared with the results from a model that included assessment test scores as variables (so that students with missing test scores could be included in the sample). Because the models that excluded students with missing assessment test scores produced a bigger (less conservative) estimated effect for the on-track indicator than the models that included them, assessment test scores were included in the model.

Another concern related to casewise deletion was that certain groups of students might be disproportionately excluded from the sample. As shown in tables C3 and C4, however, the samples for research question 3 were similar to the samples for research questions 1 and 2 in the distribution of student characteristics.

Statistical descriptions of the analytic samples

Comparing the distribution of student characteristics across analytic samples shows, for both districts, a similar distribution of student characteristics across cohorts and research questions.

TABLE C3

Distribution of grade 9 students in the District A study samples, by research question and student subgroup, 2005/06–2008/09

Student subgroup	2005/06						2006/07						2007/08		2008/09		2009/10	
	Question 1		Question 2		Question 3		Question 1		Question 2		Question 3		Question 1		Question 1		Question 1	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Complete sample	2,941	100	2,596	100	2,006	100	2,810	100	2,518	100	1,989	100	2,666	100	2,771	100	2,337	100
Gender																		
Female	1,499	51	1,342	51.7	1,059	52.8	1,437	51.1	1,299	51.6	1,034	52	1,335	50.1	1,398	50.5	1,183	50.6
Male	1,442	49	1,254	48.3	947	47.2	1,373	48.9	1,219	48.4	955	48	1,331	49.9	1,373	49.5	1,153	49.3
Race/ethnicity																		
White	627	21.3	536	20.6	433	21.6	616	21.9	546	21.7	447	22.5	518	19.4	554	20	560	24
Other race/ethnicity ^a	2,314	78.7	2,060	79.4	1,573	78.4	2,194	78.1	1,972	78.3	1,542	77.5	2,148	80.6	2,217	80	1,777	76
Program participation																		
Students with an individualized education program	672	22.8	583	22.5	437	21.8	598	21.3	520	20.7	402	20.2	577	21.6	582	21	430	18.4
Age at the start of freshman year																		
14 or under	1,822	62	1,649	63.5	1,313	65.5	1,781	63.4	1,634	64.9	1,322	66.5	1,679	63	1,710	61.7	2,212	94.7
Over 14	1,119	38	947	36.5	693	34.5	1,029	36.6	884	35.1	667	33.5	987	37	1,061	38.3	125	5.3
Grade 8 proficiency level on state math assessment^b																		
Proficiency data missing	682	23.2	581	22.4	na	na	638	22.7	525	20.8	na	na	673	25.2	777	28.0	512	21.9
Proficiency data available	2,259	76.8	2,015	77.6	2,006	100	2,172	77.3	1,993	79.2	1,989	100	1,993	74.8	1,994	72.0	1,825	78.1
Met or exceeded proficiency ^c	884	30.1	812	31.3	812	40.5	1,147	40.8	1,073	42.6	1,073	53.9	1,128	42.3	1,069	38.6	1,002	42.9
Did not meet proficiency ^c	1,375	46.7	1,203	46.3	1,194	59.5	1,025	36.5	920	36.6	916	46.1	865	32.5	925	33.4	823	
Grade 8 proficiency level on state reading assessment^b																		
Proficiency data missing	690	23.5	585	22.5	na	na	637	22.7	525	20.8	na	na	671	25.2	786	28.4	524	22.4
Proficiency data available	2,251	76.5	2,011	77.5	2,006	100	2,173	77.3	1,993	79.2	1,989	100	1,995	74.8	1,985	71.6	1,813	77.6
Met or exceeded proficiency ^c	1,484	50.4	1,344	51.8	1,343	66.9	1,313	46.7	1,221	48.5	1,221	61.4	1,360	51	1,297	46.8	1,102	47.2
Did not meet proficiency ^c	767	26.1	667	25.7	663	33.1	860	30.6	772	30.7	768	38.6	635	23.8	688	24.8	711	30.4

na is not applicable: students with missing data were excluded from the analysis.

a. Includes Asian, Black, Hispanic, Native American, and multiracial students, who were grouped into a single category because of the small numbers of non-Black minority students.

b. The state classifies assessment test scores into five proficiency categories. The proficient category and two above-proficient categories were combined to create the “met or exceeded proficiency” category; two below-proficient categories were combined to create the “did not meet proficiency” category.

c. As a percentage of students in the sample for whom proficiency data were available.

Source: Authors’ analysis of student records provided by District A.

TABLE C4

Distribution of grade 9 students in the District B study samples by research question and student subgroup, 2005/06–2009/10

Student subgroup	2005/06						2006/07						2007/08		2008/09		2009/10	
	Question 1		Question 2		Question 3		Question 1		Question 2		Question 3		Question 1		Question 1		Question 1	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Complete sample	2,777	100	2,478	100	2,118	100	2,798	100	2,507	100	2,185	100	2,853	100	3,029	100	2,969	100
Gender^a																		
Female	1,394	50.2	1,250	50.4	1,078	50.9	1,372	49.0	1,245	49.7	1,100	50.3	1,420	49.8	1,439	47.5	1,445	48.7
Male	1,383	49.8	1,228	49.6	1,040	49.1	1,426	51.0	1,262	50.3	1,085	49.7	1,433	50.2	1,590	52.5	1,524	51.3
Race/ethnicity																		
White	1,388	50.0	1,277	51.5	1,147	54.2	1,274	45.5	1,187	47.3	1,074	49.2	1,277	44.8	1,319	43.5	1,265	42.6
Other race/ethnicity ^a	1,389	50.0	1,201	48.5	971	45.8	1,524	54.5	1,320	52.7	1,111	50.8	1,576	55.2	1,710	56.5	1,704	57.4
Program participation																		
Has an individualized education program	322	11.6	261	10.5	215	10.2	389	13.9	324	12.9	275	12.6	409	14.3	447	14.8	424	14.3
Identified as receiving free or reduced-price lunch	1,006	36.2	845	34.1	676	31.9	1,102	39.4	931	37.1	760	34.8	1,162	40.7	1,390	45.9	1,447	48.7
Identified as special education	30	1.1	20	0.8	17	0.8	42	1.5	37	1.5	32	1.5	81	2.8	125	4.1	131	4.4
Identified as an English language learner	0	0.0	0	0.0	0	0.0	30	1.1	29	1.2	10	0.5	43	1.5	71	2.3	113	3.8
Age at the start of freshman year																		
14 or under	2,286	82.3	2,056	83.0	1,783	84.2	2,277	81.4	2,066	82.4	1,826	83.6	2,397	84	2,583	85.3	2,531	85.2
Over 14	491	17.7	422	17.0	335	15.8	521	18.6	441	17.6	359	16.4	456	16	446	14.7	438	14.8
Grade 8 proficiency level on state math assessment^b																		
Proficiency data missing	444	16.0	348	14.0	na	na	393	14.0	320	12.8	na	na	398	14.0	257	8.5	252	8.5
Proficiency data available	2,333	84.0	2,130	86.0	2,118	100	2,405	86.0	2,187	87.2	2,185	100	2,455	86.0	2,772	91.5	2,717	91.5
Met or exceeded proficiency ^c	1,324	47.7	1,258	50.8	1,252	59.1	1,945	69.5	1,808	72.1	1,808	82.7	2,127	74.6	2,389	78.9	2,349	79.1
Did not meet proficiency ^c	1,009	36.6	872	35.2	866	40.9	460	16.4	379	15.1	377	17.3	328	11.5	383	12.6	368	12.4
Grade 8 proficiency level on state reading assessment^b																		
Proficiency data missing	454	16.3	356	14.4	0	0	394	14.1	321	12.8	0	0	398	14.0	279	9.2	263	8.9
Proficiency data available	2,323	83.7	2,122	85.6	2,118	100	2,402	85.9	2,186	87.2	2,185	100	2,455	86.0	2,750	90.8	2,706	91.1
Met or exceeded proficiency ^c	1,613	58.1	1,508	60.9	1,505	71.1	1,839	65.7	1,693	67.5	1,693	77.5	1,988	69.7	2,249	74.2	2,305	77.6
Did not meet proficiency ^c	710	25.6	614	24.8	613	28.9	565	20.2	493	19.7	492	22.5	467	16.4	501	16.5	401	13.5

na is not applicable: students with missing data were excluded from the analysis.

a. Includes Asian, Black, Hispanic, Native American, and multiracial students, who were grouped into a single category because of the small numbers of non-Black minority students.

b. The state classifies assessment test scores into five proficiency categories. The proficient category and two above-proficient categories were combined to create the “met or exceeded proficiency” category; two below-proficient categories were combined to create the “did not meet proficiency” category.

c. As a percentage of students in the sample for whom proficiency data were available.

Source: Authors’ analysis of student records provided by District B.

APPENDIX D

GRADUATION RATES FOR FRESHMEN IN THE 2005/06 AND 2006/07 COHORTS

This appendix presents overall graduation rates for on-track and off-track students combined.

TABLE D1

Percentage of freshmen in the 2005/06 and 2006/07 cohorts in District A who graduated within four years, overall and by student background subgroup

Student subgroup	2005/06			2006/07		
	Sample	Graduated on time	Percent of sample	Sample	Graduated on time	Percent of sample
Complete sample	2,596	1,464	56.4	2,518	1,335	53.0
Gender						
Female	1,342	829	61.8	1,299	767	59.0
Male	1,254	635	50.6	1,219	568	46.6
Race/ethnicity						
White	536	376	70.1	546	357	65.4
Other race/ethnicity ^a	2,060	1,088	52.8	1,972	978	49.6
Program participation						
Identified as having an individualized education program	583	283	48.5	520	212	40.8
Age at the start of freshman year						
14 or under	1,649	1,087	65.9	1,634	1,018	62.3
Over 14	947	377	39.8	884	317	35.9
Grade 8 proficiency level on state math assessment^b						
Proficiency data missing	581	267	46.0	525	239	45.5
Proficiency data available	2,015	1,197	59.4	1,993	1,096	55.0
Met or exceeded proficiency ^c	812	651	80.2	1,073	753	70.2
Did not meet proficiency ^c	1,203	546	45.4	920	343	37.3
Grade 8 proficiency level on state reading assessment^b						
Proficiency data missing	585	268	45.8	525	241	45.9
Proficiency data available	2,011	1,196	59.5	1,993	1,094	54.9
Met or exceeded proficiency ^c	1,344	929	69.1	1,221	833	68.2
Did not meet proficiency ^c	667	267	40.0	772	261	33.8

Note: Graduation rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06 and 2006/07 academic years for whom on-track or off-track status could be determined. Students who died, transferred out of the district, or moved out of the United States in grades 10–12 and students who transferred into the district after grade 9 were not included in graduation calculations.

a. Includes Asian, Black, Hispanic, Native American, and multiracial students, who were grouped into a single category because of the small numbers of non-Black minority students.

b. The state classifies assessment test scores into five proficiency categories. The proficient category and two above-proficient categories were combined to create the “met or exceeded proficiency” category; two below-proficient categories were combined to create the “did not meet proficiency” category.

c. As a percentage of students in the sample for whom proficiency data were available.

Source: Authors’ analysis of student records provided by District A.

TABLE D2

Percentages of freshmen in 2005/06 and 2006/07 cohorts in District B who graduated within four years, overall and by subgroup classification

Student subgroup	2005/06			2006/07		
	Sample	Graduated on time	Percent of sample	Sample	Graduated on time	Percent of sample
Complete sample	2,478	2,114	85.3	2,507	2,118	84.5
Gender						
Female	1,250	1,098	87.8	1,245	1,087	87.3
Male	1,228	1,016	82.7	1,262	1,031	81.7
Race/ethnicity						
White	1,277	1,192	93.3	1,187	1,092	92.0
Other race/ethnicity ^a	1,201	922	76.8	1,320	1,026	77.7
Program participation						
Identified as having an individualized education program	261	194	74.3	324	238	73.5
Identified as receiving free or reduced-price lunch	845	608	72.0	931	673	72.3
Identified as an English language learner	0	0	0.0	29	21	72.4
Age at the start of freshman year						
14 or under	2,056	1,819	88.5	2,066	1,790	86.6
Over 14	422	295	69.9	441	328	74.4
Grade 8 proficiency level on state math assessment^b						
Proficiency data missing	348	272	78.2	320	244	76.3
Proficiency data available	2,130	1,842	86.5	2,187	1,874	85.7
Met or exceeded proficiency ^c	1,258	1,188	94.4	1,808	1,621	89.7
Did not meet proficiency ^c	872	654	75.0	379	253	66.8
Grade 8 proficiency level on state reading assessment^b						
Proficiency data missing	356	278	78.1	321	246	76.6
Proficiency data available	2,122	1,836	86.5	2,186	1,872	85.6
Met or exceeded proficiency ^c	1,508	1,386	91.9	1,693	1,530	90.4
Did not meet proficiency ^c	614	453	73.8	493	342	69.4

Note: Graduation rates are for first-time freshmen enrolled in grade 9 at the end of the 2005/06 and 2006/07 academic years for whom on-track or off-track status could be determined. Students who died, transferred out of the district, or moved out of the United States in grades 10–12 and students who transferred into the district after grade 9 were not included in graduation calculations.

a. Includes Asian, Black, Hispanic, Native American, and multiracial students, who were grouped into a single category because of the small numbers of non-Black minority students.

b. The state classifies assessment test scores into five proficiency categories. The proficient category and two above-proficient categories were combined to create the “met or exceeded proficiency” category; two below-proficient categories were combined to create the “did not meet proficiency” category.

c. As a percentage of students in the sample for whom proficiency data were available.

Source: Authors’ analysis of student records provided by District B.

APPENDIX E REGRESSION MODEL SPECIFICATIONS AND RESULTS

This appendix describes the regression model used in the study and discusses the results.

Model specifications

To address research question 3 on how well the on-track indicator predicts four-year graduation rates, a two-level (students within schools) hierarchical generalized linear model with binary outcomes (Raudenbush and Bryk 2002) was used to examine the relationship between the on-track indicator and on-time student graduation, controlling for certain student background characteristics. This type of model is a special case of hierarchical linear model in which the outcome is binary rather than continuous and takes into account the hierarchical nature of the data.

Level 1 of the District A model included student measures related to cohort, on-track status, gender, race/ethnicity, individualized education program (IEP) status, age, and grade 8 math and reading assessment test scores. Level 1 of the District B model included student measures related to cohort, on-track status, gender, race/ethnicity, free or reduced-price lunch status, age, and grade 8 math and reading assessment test scores.

Addressing research question 3 entailed examining the extent to which these level 1 (student-level) predictors rather than level 2 (school-level) predictors account for differences in on-time graduation. Because level 1 estimates could be biased by the omission of level 2 predictors, specification tests are conducted to check whether any of the student-level predictors were vulnerable to omitted variable bias of this type (Raudenbush and Bryk 2002, p. 262). For both districts, these tests did not yield any evidence of such bias, so no level 2 predictors were included in the models.¹³

To determine whether the student-level coefficients should be specified as fixed or varying

across schools, significance tests and likelihood ratio tests were used to identify significant between-school variation in these slopes. For District A, all level 1 coefficients, except that associated with cohort, had between-school variations in slope that were not significantly different from zero. Therefore, these covariates were fixed at level 1. The coefficient associated with cohort varied significantly across schools and was therefore specified as varying at level 2. For District B, none of the level 1 coefficients showed significant variation between schools and therefore were specified as fixed.

A preliminary analysis included an interaction term (on-track indicator * cohort) to examine whether the association between the on-track indicator and on-time graduation varied across the two cohorts. The interaction term was nonsignificant and was therefore dropped from the final model, allowing more straightforward interpretation of the model results.

In the analysis, the binary outcome Y took a value of 1 if a student graduated on time and 0 otherwise. The probability of on-time graduation, $\mu_{ij} = P(Y_{ij} = 1)$ for student i in school j was transformed using the logit link. The logit is the log of the odds of the event (on-time graduation), with the odds defined as the probability of the event divided by one minus the probability of the event:

$$\eta_{ij} = \log \left(\frac{u_{ij}}{1 - u_{ij}} \right)$$

The natural logarithm e was used as the base of the logarithm function. The above transformed variable was then modeled as the outcome in the two-level models described below.

District A

Level 1, students-within-schools

$$\eta_{ij} = \pi_{0j} + \varphi_j c_{ij} + \theta_j T_{ij} + \sum \pi_{pj} X_{pij} + e_{ij}$$

where π_{0j} is the regression coefficient; c_{ij} is the cohort of student i in school j ($0 = 2005/06$ and

1 = 2006/07); T_{ij} is the freshman on-track status of student i in school j (0 = off track and 1 = on track); X_{pij} is the value of characteristic p for student i in school j (gender: 0 = male and 1 = female; race/ethnicity: 0 = White and 1 = other race/ethnicity; IEP status: 0 = no IEP and 1 = IEP; age at start of freshman year: 0 = age 14 or under and 1 = over age 14; standardized grade 8 math assessment test score; standardized grade 8 reading assessment score); and e_{ij} is a random error term for each student.

Math and reading assessment test scores were grand mean-centered to allow for easier interpretation of coefficients.

Level 2, schools

$$\begin{aligned}\pi_{0j} &= \beta_{00} + r_{0j} \\ \varphi_j &= \gamma_{01} + r_{0j} \\ \theta_j &= \gamma_{02} \\ \pi_{pj} &= \gamma_{03}\end{aligned}$$

where β_{00} is the average log-odds of graduating across schools, γ_{01} is the average cohort effect for students who are not on track (adjusted for their baseline characteristics), and r_{0j} is a school-level random error term.

District B

Level 1, students-within-schools

$$\eta_{ij} = \pi_{0j} + \varphi_j c_{ij} + \theta_j T_{ij} + \sum \pi_{pj} X_{pij} + e_{ij}$$

where π_{0j} is the regression coefficient; c_{ij} is the cohort of student i in school j (0 is 2005/06 and 1 is 2006/07); T_{ij} is the freshman on-track status of student i in school j (0 is off track and 1 is on track); X_{pij} is the value for characteristic p for student i in school j (gender: 0 = male and 1 = female; Asian ethnicity: 0 = White and 1 = Asian; Black or Hispanic ethnicity: 0 = White and 1 = Black or Hispanic; free or reduced-price lunch status: 0 = did not receive and 1 = received; age at start of freshman year: 0 = age 14 or under and 1 = over age 14); standardized grade 8 math assessment test score;

standardized grade 8 reading assessment score); and e_{ij} is a random error term for each student.

Math and reading assessment test scores were grand mean-centered to allow for easier interpretation of coefficients.

Level 2, schools

$$\begin{aligned}\pi_{0j} &= \beta_{00} + r_{0j} \\ \varphi_j &= \gamma_{01} \\ \theta_j &= \gamma_{02} \\ \pi_{pj} &= \gamma_{03}\end{aligned}$$

where β_{00} is the average log-odds of graduating across schools, γ_{01} is the average cohort effect for students who are not on track (adjusted for their baseline characteristics), and r_{0j} is a school-level random error term.

The analytic sample for District A included 3,994 students from two cohorts in 17 schools. School size averaged 235 students and ranged from 46 students to 638 students. The analytic sample for District B included 4,303 students from two cohorts in 7 schools. School size averaged 615 students and ranged from 21 students to 1,122 students. Statistical descriptions of the samples are presented in tables C3 and C4 in appendix C.

Results

Tables E1 and E2 present the coefficient estimates with standard errors and the odds ratios for the variable in the logistic regression models. Each coefficient represents an estimate of the degree to which the log-odds of graduating on time is associated with each predictor, holding all other predictors constant. Odds ratios indicate the multiplicative change in odds associated with each unit increase in the predictor (a change from 0 to 1 for a dummy variable or an increase of one standard deviation for assessment test scores), holding constant the values of all other predictors.

The regression analysis showed a statistically significant relationship (at the 0.001 significance

level) between on-track status and the probability of graduating within four years, controlling for student background variables and cohort. Students who were on track at the end of their freshman year graduated at higher rates than students who were off track.

For District A, the regression analysis also revealed associations between on-time graduation and each student background variable, holding constant all other variables (see table E1). Students were more likely to graduate if they were female, were in the other race/ethnicity subgroup, had an IEP,¹⁴ were age 14 or under, and scored higher on the grade 8 math or reading assessment. The relationship between graduation and each of these variables was significant at the 0.01 level. On-time graduation was not found to have a significant association with cohort.

For District B, the regression analysis revealed associations between on-time graduation and some of the student background variables, holding

constant all other variables (see table E2). Students were more likely to graduate if they were female, were White, did not receive free or reduced-price lunch, were age 14 or under, and scored higher on the grade 8 math assessment. The relationship between graduation and each of these variables was significant at the 0.001 level. On-time graduation was not found to have a significant association with cohort, Asian (as compared with White) ethnicity, or having scored higher on the grade 8 reading assessment.

The odds ratios in tables E1 and E2 indicate how many times higher the estimated odds of on-time graduation are with each unit increase in the predictor (a change from 0 to 1 for a dichotomous variable or an increase of one standard deviation for assessment test scores), holding constant the values of all other predictors. For the on-track indicator, the odds ratio estimated by the regression model was 6.6 for District A and 5.5 for District B. For both districts, the odds ratio for on-track status was larger than the odds ratios for all other predictors.

TABLE E1

Regression analysis results for District A

Predictor	Estimated coefficient	Standard error	Odds ratio	Odds ratio: 95 percent confidence interval
On-track	1.9***	0.1	6.6	5.5–7.9
Female	0.3***	0.1	1.4	1.2–1.6
Other race/ethnicity	0.7***	0.1	1.9	1.5–2.5
Identified as having an individualized education program	0.7***	0.1	2.1	1.7–2.6
Over age 14	–0.5***	0.1	0.6	0.5–0.7
One standard deviation above the mean on grade 8 math assessment	0.4***	0.1	1.4	1.2–1.6
One standard deviation above the mean on grade 8 reading assessment	0.4***	0.1	1.5	1.3–1.7
Cohort	0.2	0.2	1.2	0.8–1.8

***Significant at the 0.001 level.

Source: Authors' analysis of student records provided by District A.

TABLE E2

Regression analysis results for District B

Predictor	Estimated coefficient	Standard error	Odds ratio	Odds ratio: 95 percent confidence interval
On-track	1.7***	0.1	5.5	4.4–7.0
Female	0.5***	0.1	1.7	1.4–2.1
Asian	0.3	0.3	1.5	0.8–2.4
Black or Hispanic	–0.4***	–0.1	0.6	0.5–0.8
Identified as receiving free or reduced-price lunch	–0.6***	0.1	0.6	0.4–0.7
Over age 14	–0.7***	0.1	0.5	0.4–0.6
One standard deviation above the mean on grade 8 math assessment	0.6***	0.1	1.7	1.5–2.1
One standard deviation above the mean on grade 8 reading assessment	0.1	0.1	1.1	0.9–1.3
Cohort	0.1	0.1	1.1	0.9–1.3

***Significant at the 0.001 level.

Source: Authors' analysis of student records provided by District B.

NOTES

1. Stillwell, Sable, and Plotts (2011) applied the averaged freshman graduation rate, a method used by the National Center for Education Statistics to estimate the percentage of public high school freshmen who graduate with a regular diploma four years after starting grade 9 (Seastrom et al. 2006a, 2006b). Under this method, the rate for 2008/09 (the freshman class in the fall of 2005) equals the total number of diploma recipients in 2008/09 divided by the average enrollment of grade 8 students in 2004/05, grade 9 students in 2005/06, and grade 10 students in 2006/07.
2. High-poverty schools are defined as schools with 76–100 percent of their enrollment eligible for free or reduced-price lunch. Low-poverty schools are those with 0–25 percent of eligible students. The graduation rate data were drawn from the 2007/08 Public School Data File of the Schools and Staffing Survey.
3. Twenty-four states reported having student-level early warning indicator systems or readiness reports in the 2009/10 survey conducted by Data Quality Campaign (2010). Districts also are increasingly mining and analyzing their data sets to identify specific indicators that provide early signals that students are falling off track to graduation. Some well known examples are Chicago Public Schools (Allensworth and Easton 2005, 2007), Baltimore City Public Schools (Mac Iver and Mac Iver 2010), Boston Public Schools (Pinkus 2008), the School District of Philadelphia (Neild, Balfanz, and Herzog 2007), and Prince George's County Public Schools in Maryland (Prince George's County Public Schools 2010).
4. The four-year graduation rate is of particular interest because it is currently the only graduation rate monitored for federal accountability purposes.
5. The third district interested in this study was unable to provide the complete data necessary for analysis.
6. The findings in this section do not include graduation rates for students whose on-track status could not be determined at the end of grade 9 because their course records were incomplete. For the District A sample, these include 72 students in the 2005/06 cohort (2.7 percent of the sample), of which 11 (15.2 percent) graduated on time, and 42 students in the 2006/07 cohort (1.7 percent of the sample), of which 10 (23.8 percent) graduated on time. These graduation rates should be interpreted with caution because the study team was unable to determine why some of these students had incomplete course records or whether these students were on track or off track at the end of their first year of high school.
7. The findings in this section do not include graduation rates for students whose on-track status could not be determined at the end of grade 9 because their course records were incomplete. For the District B sample, these include 81 students in the 2005/06 cohort (3.3 percent of the sample), of which 33 (40.7 percent) graduated on time, and 59 students in the 2006/07 cohort (2.4 percent of the sample), of which 23 (38.9 percent) graduated on time. These graduation rates should be interpreted with caution because the study team was unable to determine why some of these students had incomplete course records or whether these students were on track or off track at the end of their first year of high school.
8. The results for the first two research questions show higher on-track rates and on-time graduation rates for District B than for District A (see appendix C). It is not within the scope of this study to compare these two districts or to explain on-track rates or on-time graduation rates for either district.
9. To further examine the predictive strength of the on-track indicator, a model similar to

that described in appendix E was run for each district, but with on-time graduation predicted only by on-track status. The difference between the odds of on-time graduation in models that included baseline student background characteristics (the primary model described in this section and appendix E) and in models that excluded baseline characteristics (reported in this footnote) suggest that student background characteristics, prior test scores, and cohort accounted for part of the relationship between on-track status and on-time graduation. For District A, when only on-track status was used as a predictor, the odds of on-time graduation for students who were on track at the end of their freshman year was estimated to be 7.84 times that of students who were off track at the end of their freshman year (with a 95 percent confidence interval of 6.62–9.30). This is larger than the odds of on-time graduation found in the primary model reported in this section, which estimated an odds ratio of 6.57. For District B, when on-track status was used as the only predictor, the odds of on-time graduation for students who were on track at the end of their freshman year was estimated to be 9.25 times that of students who were off track at the end of their freshman year (with a 95 percent confidence interval of 7.42–11.54). This too is larger than the odds of on-time graduation found in the primary model reported in this section, which estimated an odds ratio of 5.54. The finding that the odds ratios estimated using only on-track status are larger than the odds ratios estimated with the student background characteristics is the expected result if student background characteristics are themselves related to on-time graduation.

10. When students with missing test scores were included in the model using imputed values for the missing scores, estimated coefficients

varied by less than 2 percent and retained their statistical significance; see tables C3 and C4 in appendix C.

11. Data needed to analyze five-year graduation rates in Districts A and B were not available at the time of data collection.
12. Hierarchical linear models delete observations with missing data on any level 1 variable. The results of a model that included all students and that estimated missing grade 8 test scores through multiple imputation procedures using student demographic data were compared with the results of the model for the analytic sample from the study (excluding students with missing test scores) and the full sample (including students with missing test scores by using imputed values). All estimated coefficients differed by less than 2 percent. It is possible that imputation using academic variables, such as grade 8 grade point average or grade 7 tests scores, would yield different results. However, data for these academic variables were not available in the study dataset.
13. Hierarchical models are most appropriate in cases where the level 1 intercept varies significantly across level 2 units. This was the case for District A, where between-school variation was significant at $p < 0.05$ but was not the case for District B. In this study, a hierarchical model was used to take into account the clustering of students within schools and to obtain more conservative standard errors, reducing the risk of Type I error.
14. The regression results indicate that once on-track status, other student background characteristics, and grade 8 assessment test scores were taken into account, higher graduation rates were predicted for non-White students than for White students and for students with an IEP than for students without one.

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