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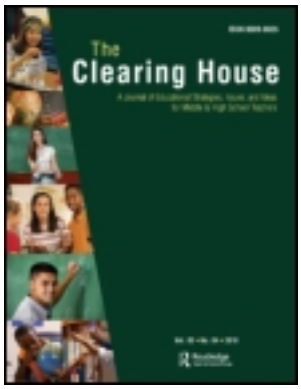

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Longitudinal Attendance Patterns: Developing High School Dropouts

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Longitudinal Attendance Patterns: Developing High School Dropouts

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Abstract: The elementary and middle grades are a time of great developmental changes with the potential to impact children's longer-term growth. As students progress through their formal schooling during these time periods, the potential exists for children either to follow a course of healthy development associated with positive outcomes or to experience frustration and incompetence associated with disengagement and disinterest in school. The ability of district personnel to detect divergent paths manifest in student data patterns is paramount to the early identification of students at risk of disengagement and subsequent academic failure. The current study explores the use of group-based trajectory modeling to categorize students into longitudinal groups based on attendance patterns. Distinct patterns of attendance are displayed and risk factors associated with group membership are explored. Finally, the relation to attendance patterns and dropout rates is revealed.

Keywords: longitudinal attendance, trajectory models, high school dropout

The elementary and middle grades are a time of great developmental changes with the potential to impact children's longer-term growth. Contributing to this development are changes in biological, cognitive, and social factors that help to shape children's sense of self. Eccles (1999) suggests that this development can be categorized into two separate time periods: middle childhood, when children are ages 6–10, and early adolescence, when children are ages 11–14. As students progress through their formal schooling during these time periods, the potential exists for children to follow a course of healthy development associated with positive outcomes or to experience frustration and incompetence associated with disengagement and disinterest in school. Environments not accustomed to these latter students' needs may instill a lack of confidence and inadequacy, resulting in elevated reports of depression (Cole 1991) and aggression (Parkhurst and Asher 1992), leading to longer-term difficulties exhibited by outcomes such as grade retentions, truancy, and dropping out of high school (Achenbach et al. 1992; Alexander, Entwisle, and Horsey 1997; Cairns, Cairns, and Meckerman 1989; Eccles 1999; Offord and Fleming 1995; Rutter 1988). Children engage in avoidance tactics to remove themselves from activities where they perceive themselves as having a low likelihood of success (Kazdin 1993; Simmons and Blyth 1987); in effect disengaging from school exhibited by low school attendance patterns. The ability to detect divergent paths manifest in student data patterns is paramount to the early identification of students at risk of disengagement and subsequent academic failure.

The Dropout Literature

The negative consequences associated with dropping out have been well-documented, including lower average incomes (U.S. Department of Education, National Center for Education Statistics 2008), higher incidence of unemployment (Martin and Halpern 2006; U.S. Department of Labor, Bureau of Labor Statistics 2006), and an increased likelihood of experiencing health issues (U.S. Department of Education, National Center for Education Statistics 2004). In addition, dropouts are more likely to be incarcerated (U.S. Department of Justice, Bureau of Justice Statistics 2002) and are two-and-a-half times more likely to die at a younger age (Martin and Halpern 2006).

Not only does a decision to drop out of school impact the individual student, but the rest of America also suffers. Martin and Halpern (2006) estimate the lost lifetime revenue for male dropouts between the ages

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of 25 and 34 is approximately $944 billion dollars, and costs associated with poor health and criminal activity have been estimated at $24 billion. The limited education and skills dropouts possess result in the acquisition of lower-paying jobs and a reduced contribution to the U.S. tax base, with estimates suggesting tax contributions at approximately half the rate of a high school graduate, equating to about $60,000 less over their lifetime. Given the impact on students' lives and American society overall, researchers have long recognized the importance of identifying dropouts, and factors predictive of dropout, before they leave school

Student-Level Predictors

Throughout the past 30–40 years, a great number of studies have shown a multitude of factors associated with student decisions to drop out. Most ubiquitously explored in the literature is the association between student decisions to drop out and their family's level of income, or socioeconomic status (SES). Generally, low SES students tend to be more likely to drop out of high school (Axinn, Duncann, and Thorton 1997; Christle, Jolivette, and Nelson 2007; Rumberger 1995; Rumberger and Larson 1998; Rumberger and Thomas 2000), although some work has shown variability in the SES-dropout relationship over time and parental employment status (Orthner and Randolph 2004; Randolph et al. 1999).

Less clear associations exist between student demographic characteristics and their decisions to drop out. Historically, minority students have been shown to be more likely to drop out of high school than white students (Christle, Jolivette, and Nelson 2007; U.S. Department of Education, National Center for Education Statistics 2008), although Goldschmidt and Wang (1999), Lee and Burkham (2003), and Randolph et al. (2004) found evidence suggesting that African American students are less likely than or equally as likely to drop out as white students when making use of longitudinal analytic methods, noting the U.S. Department of Education's report on the educational achievement of blacks and whites showing subgroup dropout rates that have begun to converge.

Although a student's decision to drop out may manifest itself as an abrupt event, in all likelihood the negative feelings toward school existed for some time, culminating in the decision to leave school (Alexander, Entwisle, and Horsey 1997; Alexander, Entwisle, and Kabbani 2001; Balfanz, Herzog, and Mac Iver 2007; Neild, Balfanz, and Herzog 2007). Work by Balfanz, Herzog, and Mac Iver (2007) and Neild, Balfanz, and Herzog (2007) using Philadelphia Public School System data has shown that middle school indicators such as failing grades in English and math, unsatisfactory behavior, and an attendance rate below 80 percent represent a reduction in effort and engagement and are predictive of high school dropout. Further, they found that students with more than one of these flags had higher probabilities of dropping out than students with only a single flag, suggesting that as early as sixth grade, students have already begun to disengage from the academic experience.

Ninth grade is the high school year where most dropouts tend to occur, due to increased academic demands, social adjustments to the new high school environment, and an increased responsibility for their own academic progress (Clement and Sutton 2001; Neild, Balfanz, and Herzog 2007). The propensity for ninth graders to drop out of school necessitates the identification of indicators exhibited earlier in students' academic careers (Balfanz, Herzog, and Mac Iver 2007; Neild, Balfanz, and Herzog 2007). Unfortunately, the identification of early warning signals of school dropout has lagged behind the growing concern over the dropout crisis (Jerald 2006), and only limited focus has been devoted to investigating the dropout phenomenon from a longitudinal perspective (Alexander, Entwisle, and Kabbani 2001; Balfanz, Herzog, and Mac Iver 2007; Ensminger and Slusarick 1992; Neild, Balfanz, and Herzog 2007). Most work completed to date regarding the prediction of dropout has focused on information collected through large, administrative surveys not easily transferable to local contexts—grounded, actionable information is necessary. School systems need assistance making use of the information they have readily available to them for the early identification of their at-risk student population.

Attendance

In large, urban school districts serving high-poverty areas, where elevated dropout rates are common, schools and principals (Heaviside et al. 1998) tend to report high rates of daily absenteeism as a severe problem. Elevated rates of absenteeism are indicative of student disengagement from the educational process, including an increased likelihood of eventual high school drop out (Alexander, Entwisle, and Horsey 1997; Balfanz, Herzog, and Mac Iver 2007; Barrington and Hendricks 1989; Broadhurst, Patron, and May-Chahal 2005; Ensminger and Slusarick 1992; Kane 2006; Kaplan, Peck, and Kaplan 1995; Rumberger 1987, 1995; Rumberger et al. 1990). Poor attendance may suggest that students are uninterested in the educational environment, have competing interests outside of school, or that their family's resources may be impeding their ability to attend school on a consistent basis. Ultimately, students not present for instruction are destined to underperform, experience anxiety stemming from their perceived lack of ability, and may eventually decide to drop out of school (Alexander, Entwisle, and Horsey 1997). Researchers have also shown that students who disengage tend to establish patterns of chronic absenteeism as early as first

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grade, with increasing rates of absenteeism throughout their academic careers (Alexander, Entwisle, and Horsey 1997; Barrington and Hendricks 1989; Gottfried 2009; Hess et al. 1989) and associated negative consequences in their adult lives, including poorer health, lower paying jobs, increased likelihood of a life of poverty, and increased incarceration (Bell, Rosen, and Dynlacht 1994; Dryfoos 1990; Hawkins and Catalano 1995; Ingersoll and LeBoeuf 1997; Rohrman 1993).

Student attendance data provide a tangible indicator representing avoidance of uncomfortable situations stemming from feelings of inadequacy (Kazdin 1993; Simmons and Blyth 1987). Better understanding of student attendance patterns may not only shed light on the process of disengagement from school, but may also inform the development of programs or policies designed to deter absenteeism (Gottfried 2009) in efforts to avoid losing valuable federal and state education funding allocated based on attendance patterns (Baker, Sigmon, and Nugent 2001).

Building on the prior work conducted by Balfanz, Herzog, and Mac Iver (2007), the clear link between poor attendance and dropping out (Rumberger 2001) and the indication that disengagement from school begins early in children's academic careers (Alexander, Entwisle, and Kabbani 2001), we chose to investigate the developmental patterns of school absenteeism and their relationship to dropout. An added advantage of using attendance as our early warning sign is that many school districts collect attendance in a uniform manner across a student's entire academic career. Other indicators such as test scores, classroom grades, or even behavioral infractions may not be available or manifest across all grade levels, or may be collected through subjectively influenced means. Specifically, we chose to identify students at each grade level that missed more than 10 percent of the total number of days they were enrolled in school, translating into students with attendance rates below 90 percent.[1]

Because we are interested in understanding high school dropouts through the lens of longitudinal absentee patterns, our proposed research questions are:

1. What is the relationship between an absenteeism pattern and the likelihood of dropping out of high school?
2. What are the student profiles for the various absentee pattern groups?

Method

Research Context

The data were obtained from a large, urban school district in the southeastern United States, with a reported 2007–2008 enrollment of more than 100 students, with 42 percent reported as African American, 34 percent as white, and 15 percent Hispanic. Nearly 48 percent of students were economically disadvantaged, 16 percent were limited English proficient (LEP), and approximately 10 percent were reported as having exceptional child (EC) status. State school report cards showed that 55.2 percent of students in grades 3 through 8 were proficient in reading and 67.7 percent were proficient in math based on state standardized assessments. At the high school level, performance on standaridzed assessments revealed proficiency ranging from 53.1 to 76.7 percent in different subjects. Overall, the district did not make adequate yearly progress (AYP) for 2007–2008, reaching only 55 of 78 performance targets. The district had a higher reported dropout rate for grades 9–12 than the rate reported across the entire state.

Data for Analysis

Longitudinal data spanning grades 1 through 12 was retrieved from the district's data warehouse, including active students during the 1997–1998 through the 2008–2009 school year with records spanning both high school and middle school. Each students' percent attendance was calculated as the number of days enrolled minus the number of days absent, divided by the number of days enrolled for each year of available data. Student dropout status was represented as a dichotomous dependent variable that assumes a value of 1 if the student drops out any time during high school in grades 9 through 12 based on district withdrawal code schemes.

Table 1 shows the breakdown of available data by year and grade level, while table 2 shows the breakdown by demographic variables.

Potential Predictors

In addition to specifically modeling the longitudinal patterns of attendance behavior, we also explored a number of time-invariant student demographic predictors based on the dropout literature. We hoped to provide a profile of the typical student representing each attendance pattern trajectory group. Readers should note the exclusion of a free or reduced lunch (FRL) variable, as access is prohibited by the National School Lunch Act (NSLA) of 1946, overseen by the U.S. Department of Agriculture.

Models and Analyses

Many psychosocial phenomena develop longitudinally. Group-based trajectory modeling, a hybrid form of structural equation modeling (SEM) and random coefficient modeling (RCM), is a probability-based method of modeling longitudinal data into distinct subgroups (Jones, Nagin, and Roeder 2001). Both time invariant and variant covariates can be modeled to determine group membership and trajectory form, respectively (see figure 1 in Jones, Nagin, and Roeder 2001), and methods are also available for testing the

TABLE 1. Grade by Year Frequencies of Available Data

	Grade Level												
School Year	1	2	3	4	5	6	7	8	9	10	11	12	Total
1998–1999	5,570	5,762	5,653	0	0	0	0	0	0	0	0	0	16,985
1999–2000	5,455	5,728	6,016	5,581	0	0	0	0	0	0	0	0	22,780
2000–2001	4,721	5,804	6,151	6,028	5,532	0	0	0	0	0	0	0	28,236
2001–2002	13	5,216	6,084	6,137	5,960	5,432	0	0	0	0	0	0	28,842
2002–2003	3	14	5,786	6,121	6,231	6,029	5,366	0	0	0	0	0	29,550
2003–2004	0	1	14	5,867	6,103	6,224	6,014	5,270	0	0	0	0	29,493
2004–2005	0	0	0	12	5,915	6,097	6,175	5,956	4,753	1	0	0	28,909
2005–2006	0	0	0	0	8	5,984	6,114	6,182	5,454	4,121	2	0	27,865
2006–2007	0	0	0	0	0	8	6,082	6,139	6,048	4,614	3,800	16	26,707
2007–2008	0	0	0	0	0	0	7	6,220	6,411	5,050	4,238	3,559	25,485
2008–2009	0	0	0	0	0	0	0	0	7,232	5,396	4,669	4,380	21,677
Total	15,762	22,525	29,704	29,746	29,749	29,774	29,758	29,767	29,898	19,182	12,709	7,955	286,529

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significance of parameters and model fit (see Jones and Nagin [2007] for details).

Results

Model identification is a two-stage process beginning with the identification of the appropriate number of groups to be modeled followed by the trajectory form to be modeled (Nagin 2005). Based on maximum BIC_1 (Bayesian Information Criterion) and BIC_2 values, along with the probability correct model statistic (Nagin 2005), the appropriate number of groups to retain is five. However, instability in trajectory forms suggested that a four-group model was better supported by the data (personal communication with D. S. Nagin, January 3, 2010), with a single group represented as a flat line and the remaining three as cubic relationships. Figure 1 depicts the four group developmental attendance trajectories. Grades 1 through 8 are plotted on the x axis, and the prevalence of students missing more than 10 percent of their registered days is plotted on the y axis.

Group 1 we labeled the Constant Attendees group, as these students (79.3%) rarely missed more than 10 percent of the registered school days. Group 2 we labeled the Developing Truants (9.8%), as these students exhibited patterns of increased prevalence of absenteeism beginning in late elementary with stronger patterns seen throughout middle school. Early Truants (Group 3; 7.6%) had a greater prevalence for missing more than 10 percent of their registered days during the early elementary years, while Chronic Truants (Group 4; 3.4%) exhibited the highest prevalence of missing school across all grade levels, with a further increase during the late elementary/early middle school years.

Table 3 displays the average probability of student group membership, where the ideal assignment probability for each student would be 1, although a suggested rule of thumb is .7 (Nagin 2005). The diagonal of average probabilities (in bold) reveals that only the Early Truants group missed the .7 cutoff, suggesting the model did a fairly good job of assigning students to the appropriate trajectory groups, although a great

TABLE 2. Demographic Descriptive Statistics for Available Sample

	Female		Male		Non-LEP		LEP		Non-EC		EC		Race Total	
Race	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Asian	605	48.2	650	51.8	762	60.7	493	39.3	1,144	91.2	111	8.8	1,255	4.2
African American	7,320	50.7	7,124	49.3	14,351	99.4	93	0.6	12,114	83.9	2,330	16.1	14,444	48.0
Hispanic	986	50.8	956	49.2	674	34.7	1,268	65.3	1,802	92.8	140	7.2	1,942	6.5
Native American	99	53.5	86	46.5	177	95.7	8	4.3	160	86.5	25	13.5	185	0.6
Multi	180	51.4	170	48.6	330	94.3	20	5.7	318	90.9	32	9.1	350	1.2
White	5,894	49.4	6,029	50.6	11,747	98.5	176	1.5	9,892	83.0	2,031	17.0	11,923	39.6
Total	15,084	50.1	15,015	49.9	28,041	93.2	2,058	6.8	25,430	84.5	4,669	15.5	30,099	100.0

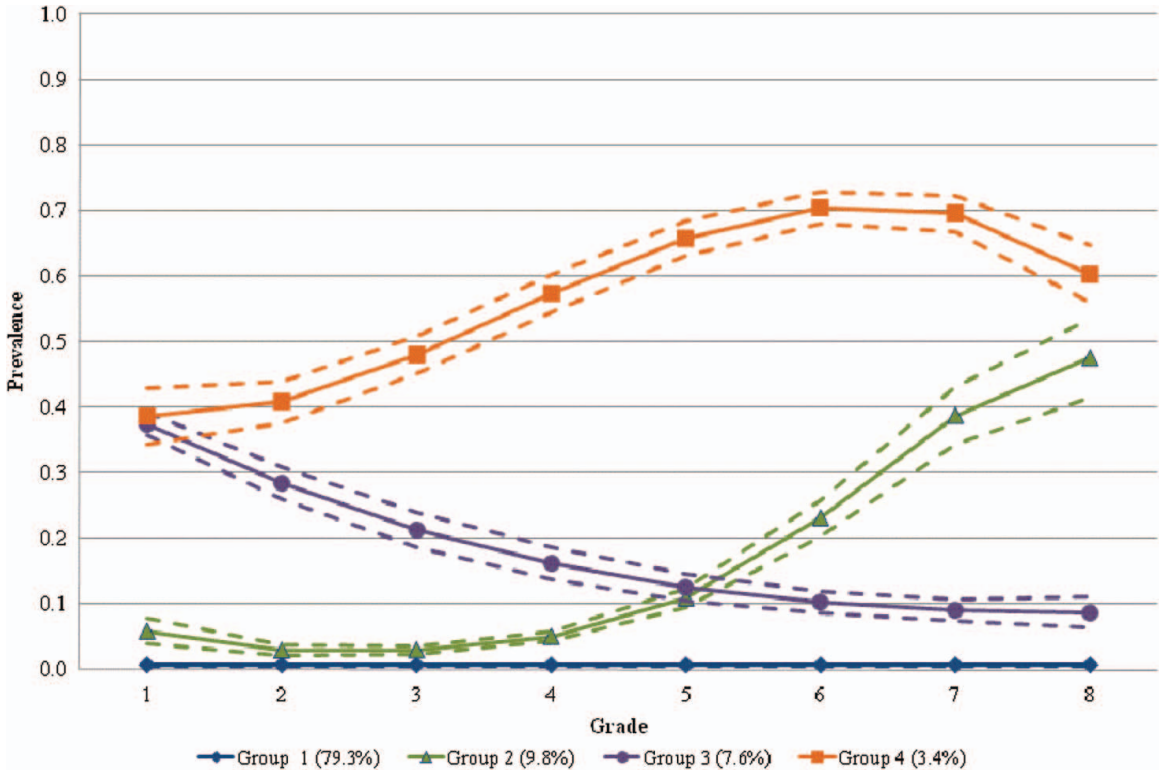

FIGURE 1. Four group Attendance Trajectories with 95 Percent Confidence Intervals. (Color figure available online.)

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deal of variability exists among students in the Constant Attendee group, making accurate assignment of students to this group difficult. In particular, some of the Early Truants could potentially be classified in the Constant Attendee group, and vice versa.

Table 4 displays the resultant coefficients and *p* values associated with our demographic predictors for the Developing Truants, Early Truants, and Chronic Truants groups, as the Constant Attendee group served as the reference group. Here, a positive coefficient suggests that the variable increases the probability of group membership (relative to membership in the Constant Attendee group) while a negative coefficient suggests a decreased probability. Note that the LEP, EC, and race dichotomies are coded so that 1 equals possession of the attribute. For example, a student with an LEP value of 1 means that the student is limited English proficient. The gender variable is also a dichotomy, where 1 represents male students. As an example, the positive coefficient associated with Hispanic students' membership in the Early Truants group suggests that Hispanic students are more likely to be classified as members of this group than they are to be classified as members of the Constant Attendee group.

Table 5 builds on the information in table 4, displaying the proportion of students in each attendance trajectory group that possess each risk factor. For example, 25.2 percent of Chronic Truants students are EC, 54.6 percent are male, and 51.4 percent are African American.

Figure 2 shows the dropout rates by attendance trajectory group, along with the 95 percent confidence

TABLE 3. Posterior Probability Information By Group Assignment

	Assigned Stat.		Predicted Group			
Assigned Group	*n*	%	Group 1	Group 2	Group 3	Group 4
Constant Attendee	24,720	82.1	**0.937**	0.028	0.034	0.000
Developing Truants	2,840	9.4	0.148	**0.700**	0.106	0.045
Early Truants	1,553	5.2	0.175	0.096	**0.678**	0.051
Chronic Truants	986	3.3	0.000	0.101	0.073	**0.825**

TABLE 4. Risk Factor Coefficients

	Developing Truants			Early Truants			Chronic Truants		
Variable	Estimate	Std. Error	*p*	Estimate	Std. Error	*p*	Estimate	Std. Error	*p*
Intercept	−2.620	0.107	0.000	−3.174	0.055	0.000	−3.535	0.095	0.000
LEP	0.563	0.121	0.000	0.358	0.184	0.051	−0.211	0.234	0.365
EC	0.587	0.073	0.000	0.475	0.096	0.000	0.686	0.087	0.000
Gender	−0.022	0.109	0.838	0.120	0.079	0.127	0.156	0.093	0.094
Asian	0.631	0.084	0.000	0.976	0.090	0.000	0.310	0.081	0.000
Black	−0.058	0.122	0.636	0.384	0.245	0.118	−1.055	0.404	0.009
Hispanic	0.718	0.131	0.000	1.265	0.172	0.000	0.679	0.194	0.001
Native American	0.954	0.291	0.001	0.975	0.421	0.021	1.179	0.313	0.000
Multi	0.699	0.234	0.003	0.321	0.476	0.500	0.750	0.279	0.007

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intervals around the rates. The high dropout rates exhibited by the Developing Truants group (24.7%), followed by the Chronic Truants (20.6%) and Early Truants (10.8%) groups, coincide with the work noting a relationship between absenteeism and decisions to drop out (Alexander, Entwisle, and Horsey 1997; Barrington and Hendricks 1989; Ensminger and Slusarick 1992; Kaplan, Peck, and Kaplan 1995; Rumberger 1987, 1995; Rumberger et al. 1990). Across these three groups, we can be 95 percent confident that the dropout rate in these groups is at least 8 percent (Early Truants) and could be as high as 27.6 percent (Developing Truants). These students, exhibiting elevated prevalence to missing more than 10 percent of their registered school days, are on a path that is significantly more likely to end in dropout when compared to students that attend school on a regular basis. The relatively high rate of dropout exhibited by students classified as Early Truants is disconcerting, as these students tended to have improved levels of attendance later in their academic careers, suggesting potentially higher levels of engagement in school.

TABLE 5. Group Profiles Based on Risk-Factor Percentages

	Group			
Variable	Constant Attendee	Developing Truants	Early Truants	Chronic Truants
LEP	6.2	10.4	12.0	5.3
EC	14.3	20.4	20.4	25.2
Male	49.5	50.2	53.1	54.6
Asian	4.4	3.5	3.6	1.0
Black	45.7	55.8	67.8	51.4
Hispanic	5.6	10.0	13.3	7.6
Native American	0.5	0.9	0.7	1.8
Multi	1.1	1.4	0.7	1.8
White	42.6	28.4	13.9	36.7

Discussion

The results presented here suggest that longitudinal patterns of student absenteeism can be categorized into distinct groups that are predictive of eventual high school dropout. The majority of students in our sample were classified into a group exhibiting a good attendance pattern (Constant Attendees) that we typically would not be concerned about while students classified as Early Truants, despite improved attendance in late elementary and middle grades, exhibited a relatively high dropout rate.

An additional group exhibited reasonable levels of attendance in the early elementary school years, but then showed an increased propensity to miss more than 10 percent of their registered school days during their middle school years. This pattern aligns with the school disengagement literature, suggesting that disinterest in school is a longitudinal process that occurs over time and manifests itself in outcome variables such as attendance and eventual dropping out of school. In fact, this group had the highest dropout rate out of the four distinct groups at about 25 percent, although the degree of confidence in this estimate is somewhat less in comparison to the other groups. Finally, the Chronic Truant group, despite comprising only a small proportion of students in our data (3.4%), exhibited an alarming pattern of truancy very early in their academic careers and posted the second highest dropout rate of nearly 21 percent. The profile of groups with an elevated prevalence for absenteeism compared to the Constant Attendee group tended to be EC, male, African American, or Hispanic students. The Constant Attendee group had the lowest proportion of LEP, EC, Hispanic, and African American students while simultaneously having the largest proportion of white students.

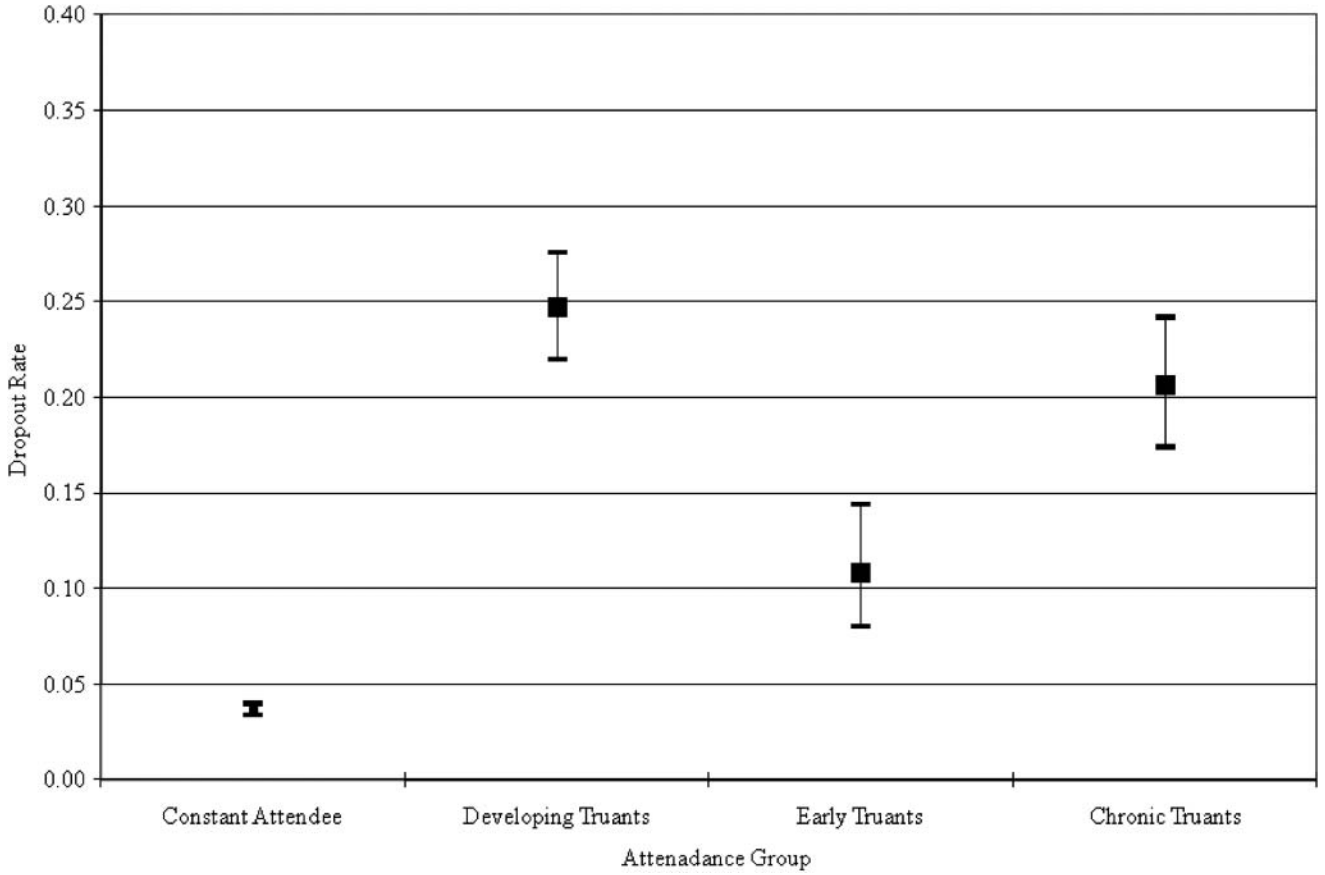

FIGURE 2. Attendance Trajectory Group Dropout Rates with 95 Percent Confidence Intervals.

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Scholars have conducted much work to establish early warning systems to help schools identify potential dropouts before they choose to leave school, including low attendance as a strong indicator of eventual dropout (Neild, Balfanz, and Herzog 2007). The trajectories and profiles outlined here can be used by district personnel to monitor students early in their academic career. Students with characteristics matching the high-risk profile or exhibiting high rates of absenteeism in earlier grades can be clustered for monitoring. Identifying students on the path to disengagement early is necessary to assist students and their families in identifying why students are not attending school and providing assistance to correct the problem.

District leaders should make use of data collection systems to compile student-level attendance patterns that can be tracked longitudinally to identify students exhibiting patterns of absenteeism that align with those shown to exist in this study. Principals at all levels should be provided these longitudinal data points for their school's students to serve as a rudimentary early warning system identifying students at-risk of disengaging from school. In turn, principals can inform teachers about students that may be at risk so they can be wary of potential warning signs that may occur in the classroom, such as increased difficulty in understanding material, incomplete homework, or inattention during instructional times. Through a collaborative effort of district-level personnel, school-based leadership, and teachers, students disengaging from school can be identified early to avoid the difficult problem of garnering student interest after it may already be too late. Larger districts with sophisticated data systems or technically proficient analysts, or partnerships with local universities or colleges can explore the development of their own predictive models.

Note

1. We initially explored using an 80 percent attendance threshold as documented by Balfanz, Herzog, and Mac Iver (2007), but very few students in Charlotte-Mecklenburg Schools exhibited attendance patterns at this level.

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