The Distribution of Dropout and Turnover Rates Among Urban and Suburban High Schools

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Although school dropout remains an important policy issue and has generated considerable research, little of this research has examined dropout as a measure of school performance. Even less attention has been paid to student turnover, another, related measure of how well schools are keeping students enrolled. This study examined the distributions of both dropout and turnover rates among a large sample of U.S. high schools and tested a series of models to explain these differences, using data from the NELS High School Effectiveness Study and nonlinear multilevel modeling. The results revealed substantial variability in school dropout and turnover rates among the high schools. Moreover, consistent with other work in this area, much of the variation in school dropout and turnover rates could be attributed to differences in the background characteristics of the students. Yet student composition, school resources, and school processes—factors that policy makers and educators control—also influenced dropout and turnover rates.

School effectiveness has been an important concern of researchers and policy makers for many years. Researchers have sought to explain why some schools are more effective than others, while policy makers have sought ways to identify and improve the performance of low-achieving schools. Central to the concerns of both is how to measure the effectiveness of schools.

The most common measure of school effectiveness is academic achievement as reflected in students' test scores. Test scores provide a direct measure of students' learning, which is viewed as one of the most important outcomes of schooling. Although students' academic achievement is affected by the background characteristics of students, research has clearly demonstrated that achievement outcomes are also affected by the characteristics of schools that students attend (Coleman, Hoffer, and Kilgore 1982; Gamoran 1996; Lee and Bryk 1989; Lee and Smith 1993; 1995; Lee, Smith, and Croninger 1997; Witte and Walsh 1990).

Another student outcome that studies of school effectiveness have examined is school dropout. Dropping out of school is considered a viable student outcome because research has demonstrated conclusively that students who drop out of

school suffer from a host of negative consequences, ranging from high unemployment and low earnings to poor health and increased criminal activity (Natriello 1986; Rumberger 1987; Weis, Farrar, and Petrie 1989). Like academic achievement, school dropout is influenced by both individual and school characteristics. As a result, school dropout rates—the proportion of students who drop out of a school—have been used as a measure of school performance in a number of studies on school effectiveness (Bryk, Lee, and Holland 1993; Bryk and Thum 1989; Coleman and Hoffer 1987; McNeal 1997; Pittman and Haughwout 1987; Rumberger 1995; Toles, Schulz, and Rice 1986; Witte and Walsh 1990).

Some studies of school effectiveness have examined a number of other student outcomes, including absenteeism (Bryk and Thum 1989), engagement (Lee and Smith 1993) and social behavior (Lee and Smith 1993). Although these measures do not represent the final outcomes of schooling in the same way that test scores and dropout rates do, they can be considered important intermediate outcomes of schooling because of their strong relationship to test scores and dropping out. Both theory and empirical research have demonstrated that students who are not engaged in school and do not attend regularly are more likely to have low test scores and a higher risk of dropping out (Newmann 1992; Rumberger 1995; Wehlage et al. 1989). Furthermore, the characteristics of schools, as well as the characteristics of students, influence these intermediate outcomes, as they do the final outcomes of test scores and dropout rates.

Another intermediate outcome, student mobility, has been receiving increasing attention in the literature. Student mobility refers to the practice of elementary and secondary students changing schools for reasons other than promotion from one school to another. In the late 1990s, several studies demonstrated that student mobility can adversely affect the final outcomes of schooling—test scores and dropout rates—even after the effects of family background, residential mobility, and prior academic achievement have been controlled (Rumberger and Larson 1998; Swanson and Schneider 1999; Temple and Reynolds 1997). Thus, student mobility can be considered a viable, intermediate student outcome just as engagement, absenteeism, and social behavior have been in previous studies.

But should student mobility be considered a measure of school effectiveness? If student mobility is due only to families moving residences—something schools have no control over—then it should not be considered an indicator of school effectiveness. Indeed, residential mobility in the United States is high. A survey of American children (Wood, Halfon, Scarla, Newacheck, and Nessim 1993) found that 75 percent of all school-age children in this country moved at least once before they were 18 years old and 10 percent moved at least six times before they were 18.

Yet a substantial body of research suggests that student mobility is, at least in part, a function of what goes on in schools. Several studies have demonstrated that up to 50 percent of school changes are associated not with students changing residences but, rather, with students leaving one school for another (Kerbow 1996; Lee and Burkam 1992; Rumberger and Larson 1998; Swanson and Schneider 1999). Theories of school dropout (Finn 1989; Wehlage et al. 1989) and empirical studies (Lee and Burkam 1992; Rumberger and Larson 1998) have indicated that both dropout and transfer behavior are related forms of voluntary departure from school that are predicated on students' participation and engagement in school. Other studies have argued that schools contribute to students' involuntary departure from school by systematically excluding and discharging "troublemakers" and other difficult students (Bowditch 1993; Fine 1991; Riehl 1999). Taken together, this research suggests that schools are at least partly responsible for student mobility and thus that mobility rates can provide a useful measure of school performance.

Regardless of the reasons for mobility, high student turnover (which reflects both dropouts and transfers) leads to a host of problems for teachers and schools. Studies have found that student turnover rates exceed 30–40 percent per year in some U.S.

schools (Kerbow 1996; McDonnell and Hill 1993; Rumberger et al. 1999). Schools with high turnover rates are more likely to experience problems matching needed services to students in a timely fashion and are more prone to disruptions to classrooms caused by students coming and going throughout the year (Lash and Kirkpatrick 1990). Moreover, they incur significant costs in continually processing students in and out of school and covering the costs of unrecovered textbooks and other school materials (Rumberger et al. 1999). Thus, turnover can be disruptive to schools, regardless of whether students drop out or transfer to other schools.

This study examined rates of student dropout and turnover among urban and suburban high schools in the United States. Although dropout rates of schools have been used previously in studies of school effectiveness, we decided to examine a broader measure of student departure from high school—student turnover. That is, we wanted to examine differences in schools based on the total number of students who left (whether or not those students actually dropped out of school) as a measure of the "holding power" of schools. One issue we wished to explore is whether these two measures yielded different conclusions about school effectiveness. An earlier study found that the school turnover rates of public and Catholic schools were more similar than the dropout rates because Catholic school students are more likely than public school students to transfer among schools (Lee and Burkam 1992). In other words, Catholic schools and public schools had similar holding power.

The study addressed two research questions:

1. To what extent do dropout and mobility rates vary among urban and suburban high schools in the United States?

2. What student and school factors explain those differences?

PREVIOUS RESEARCH

Research on school effectiveness is premised on the assumption that students' achievement is influenced, to some extent, by what happens in schools. Although Coleman and others challenged this assumption when they claimed that students' achievement was largely attributable to students' socioeconomic background, not their schools (Coleman et al. 1966), a growing body of evidence since then has demonstrated that schools do have an impact on students' achievement (Bridge, Judd, and Moock 1979; Hanushek 1986; Murnane 1981). But most research has focused on students' achievement as measured by test scores, often ignoring other student outcomes, such as dropout and mobility.

The literature suggests that schools have an influence on dropout and mobility in two ways. One way is indirectly, through general policies and practices that are designed to promote the overall effectiveness of schools. These policies and practices, along with other characteristics of schools (such as student composition and size), may contribute to *voluntary student turnover* by affecting conditions that keep students engaged in school. This perspective is consistent with several theories of school dropout and departure that view students' lack of engagement as the precursor to withdrawal (Finn 1989; Wehlage et al. 1989).

The second way that schools affect turnover is directly, through explicit policies and conscious decisions that cause students *involuntarily* to withdraw from school. These rules may concern low grades, poor attendance, misbehavior, or being overage and can lead to suspensions, expulsions, or forced transfers. This form of withdrawal is school initiated and contrasts with the student-initiated form just mentioned. This perspective considers a school's own agency, rather than just that of the student, in producing dropouts and transfers. One metaphor that has been used to characterize this process is discharge: "Students *drop out* of school, schools *discharge* students" (Riehl 1999:231).

In the next sections, we briefly review the literature related to these two perspectives. Overall, there has been little empirical research on dropout and even less on mobility from either perspective. Most of the empirical research that has been done, particularly

quantitative studies, has been undertaken within the first perspective of school effectiveness research. But some useful empirical research has been done from the second perspective, what we call school dropout research. Moreover, as we suggest in this review, these perspectives are not mutually exclusive, but, rather, complimentary perspectives that together can enhance one's understanding of how schools contribute to student dropout and mobility.

School Effectiveness Research

School effectiveness research has identified several types of factors that account for differences in school performance: (1) students' characteristics, (2) school resources, (3) structural characteristics of schools, and (4) school processes and practices. The first three factors are sometimes considered school inputs by economists and others who study schools because they refer to the "inputs" into the schooling process that are largely "given" to a school and therefore are not alterable by the school itself (Hanushek 1989). The last factor refers to practices and policies that a school does have control over and thus that are of particular interest to school practitioners and policy makers (Shavelson, McDonnell, Oakes, and Carey 1987). However, as we note later, the distinction between alterable and unalterable characteristics of schools is less clear cut from the perspective of the educational system as a whole, which suggests that a much larger share of the differences between schools could be reduced through educational policy.

Students' Characteristics Research has demonstrated that a wide variety of characteristics of individual students are related to students' achievement. They include demographic characteristics, such as ethnicity and gender; family characteristics, such as socioeconomic status (SES), family structure, and parenting style; and academic background, such as being held back and changing schools. Reviews of the literature on dropouts have found that these characteristics appear to influence dropping out in a manner similar to other forms of students' achievement, such as attendance and test scores (Natriello 1986; Rumberger 1987; Weis et al. 1989). The research on the individual determinants of changing schools is much less extensive. But several empirical studies all found that demographic, family background, and academic background characteristics influence students' mobility (Astone and McLanahan 1994; Lee and Burkam 1992; Rumberger and Larson 1998; Swanson and Schneider 1999). In general, these studies supported the notion that existing theories of school dropout (Finn 1989; Wehlage et al. 1989) can explain both dropout and transfer behavior by the degree of participation and engagement in school: The most engaged students remain in their school, the least engaged drop out, and those in between transfer to other schools (Lee and Burkam 1992; Rumberger and Larson 1998).

Students' characteristics influence students' achievement not only at the individual level, but at the aggregate or social level. That is, the social composition of students in a school can influence students' achievement apart from the effects of individual students' characteristics (Gamoran 1992). Several studies found that the social composition of schools predicts school dropout rates even after the effects of individual background characteristics of students are controlled (Bryk and Thum 1989; McNeal 1997; Rumberger 1995). A recent study of student mobility in California similarly found that half the variation in turnover rates in 51 California high schools could be attributed to differences in the background characteristics of students and the social composition of students within schools (Rumberger et al. 1999, Figure 4.1).

School Resources There is considerable debate in the research community about the extent to which school resources contribute to school effectiveness. Although there is fairly consistent support for the idea that the quality of teachers influences students' achievement, the controversy has focused on the degree to which financial resources may do so. In a major review of 187 studies that examined the effects of instructional expenditures on student achievement, Hanushek (1989:47) concluded: "There is no strong or systematic relationship between school

expenditures and student performance." As was noted earlier, Hanushek acknowledged widespread differences in students' achievement among schools, but did not attribute these differences to the factors commonly associated with school expenditures—teachers' experience, teachers' education, and class size. Hedges, Laine, and Greenwald's (1994:13) reanalysis of the same studies used by Hanushek, however, reached a different conclusion: "Reanalysis with more powerful analytic methods suggests strong support for at least some positive effects of resource inputs and little support for the existence of negative effects."

Several studies have suggested that resources influence school dropout and turnover rates. McNeal (1997) found that the pupil-teacher ratio had a positive and significant effect on high school dropout rates even after a host of individual and contextual factors that may also influence dropout rates were controlled. A study of student turnover in 51 high schools in California found that both the student-teacher ratio and the percentage of teachers with advanced degrees had a positive impact on student turnover after numerous individual and school factors were controlled (Rumberger et al. 1999).

Structural Characteristics of Schools Structural characteristics, such as school location (urban, suburban, rural), size, and type of control (public, private), also contribute to school performance. Although widespread differences in achievement have been observed among schools based on structural characteristics, what remains unclear is whether structural characteristics themselves account for these differences or whether the differences are related to differences in students' characteristics and school resources that are often associated with the structural features of schools. This issue has been most widely debated with respect to one structural feature: the difference between public and private schools. Several empirical studies (Bryk et al. 1993; Chubb and Moe 1990; Coleman et al. 1982; Coleman and Hoffer 1987) found that average achievement levels are higher in private schools, in general, and Catholic schools, in particular, than in public schools, even after differences in students' characteristics and resources were accounted for. Yet while some researchers (Chubb and Moe 1990) have contended that all private schools are better than public schools and thus that private school choice is a means of improving education, others have argued that Catholic schools, but not other private schools, are more effective and more equitable than public schools (Bryk et al. 1993). However, other researchers (Alexander and and Pallas 1985; Gamoran 1996; Willms 1985) have found little or no Catholic school advantage. Moreover, it has been suggested that controlling for differences in demographic characteristics may still not adequately control for fundamental and important differences among students in the two sectors (Witte 1992:389).

School Processes Despite all the attention and controversy surrounding the previous factors associated with school effectiveness, it is the area of school processes that many people believe holds the most promise for understanding and improving school performance. Although most *individual* schools, or at least most public schools, have little control over the characteristics of students, resources, and their structural features, they can and do have a fair amount of control over how they are organized and managed, the teaching practices they use, and the climate they create for students' learning. This latter group of features is sometimes referred to as school processes. Some researchers (Raudenbush and Willms 1995; Willms 1992) have also called them "type B effects," since when statistical adjustments are made for the effects of other factors, they provide a better and more appropriate basis for comparing the performance of schools.[1]

Research has demonstrated that a number of school processes affect students' achievement. One area that has received considerable attention recently is site-based management in which decisions about such things as the allocation of resources are made by schools, rather than their districts. Although considerable experimentation with various forms of site-based management is going on throughout the nation, as of the mid-1990s,

there was little empirical evidence to show that it affects students' achievement (Summers and Johnson 1996). However, some empirical evidence suggests that the organization of schools does affect students' performance: in particular, that "restructured" or more communal schools, in which students and teachers work more closely together, have higher achievement levels and a more equitable distribution of achievement among students than do more traditional secondary schools (Bryk et al. 1993; Lee and Smith 1993; Lee et al. 1997).

Two studies (Bryk and Thum 1989; Rumberger 1995) found that several aspects of academic and social climate predicted school dropout rates, even after the background characteristics of students and the resource and structural characteristics of schools were controlled. With regard to academic climate, they found that dropout rates were lower in secondary schools in which students took more advanced courses and reported doing more homework. In terms of social climate, one study (Bryk and Thum 1989) found that high schools with high levels of staff problems had higher dropout rates, whereas the other study found that middle schools in which a high percentage of students reported that the disciplinary policies were fair had lower rates (Rumberger 1995). Yet a more recent study (McNeal 1997) that was based on the same data as the first, but used different sets of variables and statistical techniques, found no effect of academic or social climate on high school dropout rates after controlling for the background characteristics of students, social composition, school resources, and school structure.

Research on School Dropout

Research on school effectiveness suggests that all aspects of school performance—test scores, attendance, and dropout—are influenced by a variety of school characteristics in similar ways. This perspective may help explain why some students voluntarily withdraw from school, but it does not explain why students involuntarily withdraw from school—that is, the agency of the school to "discharge" students (Riehl 1999). Although it may be difficult to identify clearly whether students voluntarily or involuntarily leave school, a recent study of student mobility in California found that one-third of the parents of mobile high school students reported that their children changed schools involuntarily (Rumberger et al. 1999, Table 4.2), while an earlier case study reported that one-quarter of a school's dropouts were forced to leave school (Fine 1991).

Another body of literature, which we call school dropout research, focuses on the direct and deliberate ways that schools discharge students. In a recent study based on this perspective Riehl (1999) suggested that two theories of organizations can be used to explain why schools discharge students. One theory, rational systems theory, posits that schools, like other organizations, rationally pursue their technical goals (Aldrich 1979; W.R. Scott 1998). Since one important goal of schools is to show that test scores are improving, one way to achieve this goal is to reduce the membership of low-achieving students through the discharge process. The other theory, institutional theory, posits that schools seek to maintain their legitimacy to the external environment by at least appearing to pursue their goals (Meyer and Rowan 1978; W.R. Scott 1995). In this view, schools may discharge not only low-achieving students, but hard-to-educate students who "do not seem to conform to the common notions of students or [whose] presence somehow compromises the school's ability to present itself as a normally functioning school" (Riehl 1999:237). Both views suggest that the demands and constraints of the external school environment play an important role in explaining the tendency of schools to discharge students.

Riehl's (1999) study of 100 public high schools in New York City in the late 1980s used both qualitative and quantitative methods to try to determine whether the technical or institutional views could best explain the discharge of students. Riehl concluded that both views were useful. From her interviews in 10 high schools, she found that staff in some schools could attend to both the desire to discharge certain students and the pres-

sure to reduce dropout rates by actively seeking to place discharged students into GED or alternative education programs, in which case discharged students would not be counted as dropouts. She also discovered that staff had considerable latitude in interpreting and enforcing certain rules about discharging students, such as the rule that students can be discharged once they reach age 17.

Other qualitative studies have verified the individual discretion and latitude that school personnel have in discharging students. In her study of a New York City high school in the early 1980s, Fine (1991) found that many low-income, minority students in the school were systematically excluded or exiled from the school's academic and social mainstream and eventually discharged by school personnel who "operate as dictated by the state, by history, by tradition, and by the demands for 'efficiency'" (p. 26). In another case study of an urban high school, Bowditch (1993) found that the school's disciplinary staff had considerable latitude in determining which students they labeled "troublemakers" and what actions they would take to "get rid" of them.

The qualitative evidence suggests that schools do, indeed, discharge students for both sound, technical reasons and institutional ones. Furthermore, as Riehl (1999) pointed out, there is a constant tension between these two forms of behavior. This tension, along with the discretionary control exercised by individual school personnel, supports the notion that the dropout and transfer of students are influenced by the same forces. Schools can determine not only whether some students stay or leave, but whether discharged students become transfers (through conscious efforts to find alternative placements) or dropouts.

Although the qualitative evidence supports the idea that both technical and institutional behavior explain the discharge process of schools, the quantitative evidence is less compelling. Riehl's (1999) quantitative study concluded that the effects of students' academic performance (as measured by attendance) on school dropout rates support the technical explanation, while the effects of students' academic background (as measured by prior test scores and being overage) support the institutional explanation. But because Riehl's study relied on available institutional data, it used limited measures of students' performance (attendance) and excluded other variables that may explain school dropout rates. Furthermore, other studies of school dropout rates, based on broader measures of student composition and other variables that measure school resources, climate, and policies, have failed to find that the composition of students' academic background affects school dropout rates (Bryk and Thum 1989; McNeal 1997; Rumberger 1995).

Summary

Research has investigated dropout and turnover as related school-level phenomena using two alternative perspectives. One is based on school effectiveness research, in which student dropout and mobility are viewed as forms of voluntary departure. Dropout and mobility, like test scores and other school outcomes, are influenced by a series of factors, including student composition, school resources, structural characteristics, and school processes. In this perspective, there is no attempt to explain whether students leave schools as dropouts or transfers, since schools largely influence these two outcomes indirectly through their effects on students' engagement.

The other perspective, school dropout research, focuses specifically on the direct, conscious actions of schools and their personnel to influence students' involuntary departure from school, either as dropouts or as transfers. In this perspective, whether students are discharged as dropouts or transfers depends, in part, on environmental demands and constraints that operate on schools.

We view both perspectives as complementary and useful for examining students' dropout and turnover at the school level. School effectiveness research can help explain why schools create conditions that cause students to leave school voluntarily, while school dropout research can help explain why schools cause students to leave school involuntarily as either dropouts or transfers.

RESEARCH METHODS

Data and Samples

The study was based on a national database of U.S. high schools developed by the National Center for Education Statistics (NCES): the National Education Longitudinal Study of 1988 (NELS:88): High School Effectiveness Study (HSES). Whereas the original NELS:88 was designed as a national representative sample of 8th-grade students and 8th-grade schools, the HSES was designed to provide a probability sample of 10th-grade students or high schools (L. A. Scott et al. 1996). Because the original sample of core NELS students who were followed into high school did not always provide a large enough sample of students to study high school effectiveness adequately,[2] HSES augmented the original sample of NELS students to obtain a representative sample of 10-grade students. This augmentation was restricted to a subset of 247 NELS high schools in the 30 largest Metropolitan Statistical Areas (MSAs) as defined by the U.S. Bureau of the Census.[3]

As was the case with NELS, neither schools nor students in HSES were sampled randomly.[4] Consequently, NCES provided a series of school and student weights to produce population estimates of 10th-grade students and schools in urban and suburban areas.[5] This study, however, used unweighted samples of both schools and students.[6] Although the resulting estimates pertain only to the schools and students in the samples, an exploratory analysis suggested that the results should yield fairly representative estimates of school dropout and turnover rates among urban and suburban schools.[7]

Because dropping out is a relatively rare event, it was important to include all respondents in the within-schools samples. Thus, our study was based on the full HSES sample of 247 schools and the 7,642 students who completed the 1990 student questionnaire.[8]

Conceptual Framework and Variables

The conceptual framework on which the study was based recognizes that students' performance is a multilevel phenomenon of students and schools (see Figure 1).[9] At the individual level, students' performance is a function of the characteristics and experiences of individual students in their respective schools. At the school level, it presents the aggregated performance of the students in a school and is a function of the characteristics of the school and its impact on the individual experiences of the students in it.

The study focused on two measures of students' performance at the school level—dropout and turnover. As we explained earlier, these two measures were selected because they provide complementary yet different

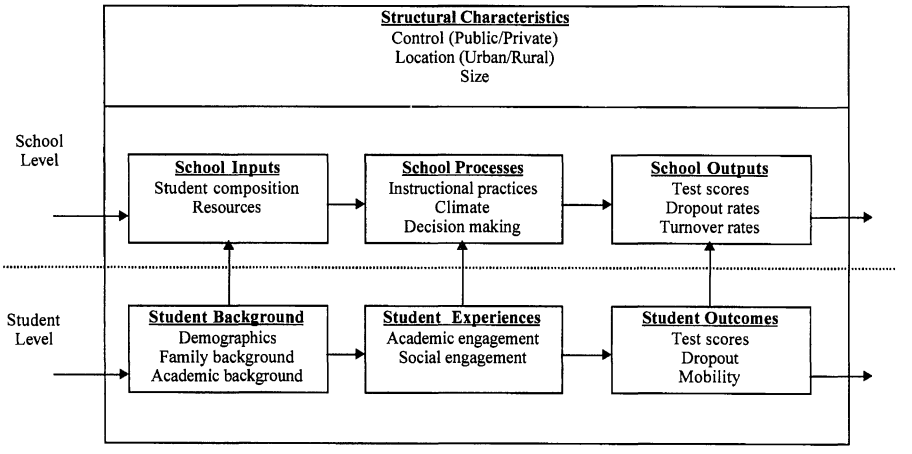

Figure 1. Conceptual Framework for Analyzing School Dropout and Turnover Rates

measures of school effectiveness. Dropout rates have been used in past studies of school performance, although less so than test scores. Turnover rates have not been used in past studies of school performance, although they may provide a more robust measure of a school's ability to retain students.

Student dropout and turnover were measured differently in the HSES data. All 10th-grade students who remained in their HSES schools for two years were identified and included in the second round of data collection in 1992. Thus, it was easy to measure student turnover for each HSES school from 1990 to 1992. But measuring student dropout over the same two-year period was more difficult because of differences in the way the two groups of students in the HSES—core NELS students and augmented students—were treated. Most core NELS students were tracked no matter where they moved (except out of the country). And a NELS student was identified as a dropout only if the school classified the student as a dropout and the respondent or the respondent's parent confirmed it. But augmented students were not tracked, so they or their parents could not confirm their dropout status. Thus, augmented students were more likely to be identified as dropouts than were core NELS students.[10] To compensate for these differences, a control variable was included in the analysis indicating whether a respondent was a core NELS student or an augmented HSES student.

The conceptual framework suggests that students' performance at the school level is a function of both student-level and school-level variables. Thus, both types of variables were included in our analysis. Because the study focused on overall dropout and turnover rates among schools, not on differences among students within schools, the only student-level variables we included were used to estimate the effects of students' background characteristics on students' dropout and turnover rates. This decision was made, in part, because the size of the within-school samples did not permit reliable estimates of the effects of student-level predictors on dropout and turnover within schools. School-level variables were used to estimate the effects of school characteristics on differences in dropout and turnover rates between schools. Detailed descriptions of all variables used in this study, together with descriptive statistics, are in Table 1.

Student-Level Variables Three types of student background variables were used in the study. The first type captures *demographic* characteristics of students, which were measured by a series of dummy variables for gender (female) and minority status (Asian, black, Hispanic, or Native American). The second type captures *family background* characteristics, which was measured by three variables: SES, a composite measure developed by NCES that reflects parental education, income, and occupational status; nontraditional families, which identifies students who did not live with both parents; and households in which an older sibling dropped out of school. Two studies (Astone and McLanahan 1994; Rumberger and Larson 1998) found that students from single-parent and stepfamilies were more mobile than students from two-parent families, suggesting that nontraditional families are more unstable and prone to move or change schools. The third type was *academic background,* which was measured by two variables: whether the student had been held back between the 1st and 8th grades and whether a student took remedial English or mathematics in the 9th or 10th grade. Both these variables predicted dropout and turnover in earlier studies (Lee and Burkam 1992; Rumberger 1995; Rumberger and Larson 1998).[11]

School-Level Variables Several types of school-level characteristics, derived from the literature on student dropout and turnover, were used in the study. The first type measured the *student composition* of schools: the mean SES of students in the school, the standard deviation of the SES of students in the school, whether the school had more than 40 percent black students or Hispanic students,[12] and the percentage of students who had been retained in Grades 1–8. These variables were computed by aggregating individual values for the student sample to the school level.[13] The second type measured the *struc-*

Table 1. Means, Standard Deviations, and Descriptions of Variables

Variable	Mean	*SD*	Minimum	Maximum	Description (HSES variable names)
Student-Level Variables (*N* = 7,642)					
Demographic characteristics					
Female	.49	.50	.00	1.00	(S1SEX = 2)
Asian	.09	.29	.00	1.00	(S1RACE = 1)
Black	.15	.36	.00	1.00	(S1RACE = 3)
Hispanic	.17	.38	.00	1.00	(S1RACE = 2)
Native American	.01	.11	.00	1.00	(S1RACE = 5)
Family background					
Socioeconomic status (SES)	.21	.82	-4.30	2.54	NCES factor composite (S2SES1)
Nontraditional family	.36	.48	.00	1.00	(S1S92A or S1S92D ne 1)
Sibling dropped out	.11	.31	.00	1.00	(S1S94 = 4,5)
Academic background					
Retained in Grades 1–8	.13	.34	.00	1.00	(S1N22A through I = 1)
Remedial courses Grades 9–10	.27	.44	.00	1.00	(S1S34A = 1 or S1S34B = 1)
Controls					
New survey student	.58	.49	.00	1.00	(S1NSSFLG = 1)
Missing SES	.04	.19	.00	1.00	(S2SES1 missing)
Student outcomes					
Dropout	.07	.25	.00	1.00	(S2DOSTAT = 3)
Leaver	.19	.40	.00	1.00	(S2DOSTAT > 0)
School-Level Variables (*N* = 247)					
Composition[a]					
Mean SES	.19	.57	-1.21	1.34	Mean SES of students (S2SES1)
SD SES	.60	.16	.00	1.17	Standard deviation of students (S2SES1)
Percentage retained Grades 1-8	.14	.12	.00	.63	Percentage of students retained in Grades 1–8
High minority	.40	.49	.00	1.00	Percentage of black and Hispanic students greater than 40 percent
Resources					
Mean student/teacher ratio	16.10	5.47	1.09	38.57	(S1C2 / S1C35)
Percentage of teachers with advanced degrees	.60	.19	.00	1.00	([S1C44C + S1C44D]/ S1C35)
Mean teacher salary (/1000)	31.94	6.43	10.20	50.00	Mean of lowest and highest salaries paid to teachers ([S1C42A + S1C42B] / 2)
Mean teacher quality	.07	.41	-.88	1.41	Mean of factor composite of students' report of teacher quality (S1S7G,H,I,K,L)[a]
Percentage of excellent teachers	.33	.23	.02	.97	Principal's report of percentage of excellent teachers (S1C92D)
Structural					
Catholic school	.13	.34	.00	1.00	G10CTRL1 = 2
Other private school	.17	.38	.00	1.00	G10CTRL1 = 3, 4, 5
Urban school	.26	.44	.00	1.00	School located in large city or inner city (S1C5B = 9, 10)

Table 1. Continued

Variable	Mean	*SD*	Minimum	Maximum	Description (HSES variable names)
School size (/100)	14.59	9.73	.00	49.00	Total school enrollment (S1C2)
Processes					
Selective school	.23	.42	.00	1.00	Admittance of all students based on tests, etc. (S1C54D = 3)
Magnet school	.17	.38	.00	1.00	Public magnet school (S1C4AB = 1)
Average daily attendance	.92	.06	.64	1.00	(S1C26)
Percentage of teacher attrition	.03	.04	.00	.26	Percentage of teachers who left at year's end (S1C50/S1C35)
Mean homework	4.84	2.12	1.38	12.57	Mean of student-reported hours of homework per week (S1S36A2)[a]
Percentage of students in academic track	.37	.26	.00	1.00	Percentage of students in academic track (S1HSPROG=2)[a]
Percentage of students who feel unsafe	.12	.12	.00	.58	Percentage of students who report feeling unsafe (S1S7M=1 or 2)[a]
Percentage of students who feel discipline is fair	.68	.14	.30	.98	Percentage of students who feel disciplinary policy is fair (S1S7D=1 or 2)[a]
Teachers' rating of principal's leadership	.01	.54	-1.87	1.31	Mean of first component of factor composite of teacher variables[b]
Teachers' control	-.04	.53	-1.61	2.04	Mean of second component[b]
Teachers' collegiality	-.03	0.48	-2.17	1.29	Mean of third component[b]
Teachers' influence on school policy	-.03	.62	-1.45	3.35	Mean of fourth component[b]
Teachers' control over classroom	.01	.43	-1.77	1.13	Mean of fifth component[b]
Teachers' rating of chair/administrative support	.01	.44	-2.57	1.28	Mean of sixth component[b]
Controls					
Missing school data	.02	.14	.00	1.00	Missing school information
Percentage of new students	.59	.24	.00	1.00	Percentage of new survey students

[a] Variable weighted at the student level with within-school weights (S1STSCWT) before aggregating to school level

[b] Factor composite created at teacher level (no weighting) before aggregating to school level.

tural characteristics of schools: whether the school was Catholic or other private (as opposed to public), whether the school was located in an urban (versus suburban) area, and the size of the school. The third type measured *school resources*: the student-teacher ratio; the percentage of teachers with advanced degrees; the mean salary of teachers at the school; the mean level of teacher quality, as ascertained from the students; and the proportion of excellent teachers, as ascertained from the principal. The final type measured *school processes* (practices and climate): whether the school selected students using tests and other admissions criteria; whether the school was a public magnet school; the average daily attendance at the school; the turnover of teachers; academic climate, as measured by the mean hours of homework reported by the students and the percentage of students on an academic track; school safety, as ascertained by the percentage of students who reported feeling unsafe at the school; disciplinary climate, as ascertained by the percentage of students who reported that the school's disciplinary policies were fair; and a series of variables measuring teachers' involvement in various aspects of school decision making and their assessment of the principal's leadership.[14]

Several aspects of the data are noteworthy. At the student level, the mean value for students' SES in the sample data is .21. Since this variable was standardized on the weighted population of NELS 10th graders, it suggests that the HSES sample of students was relatively more advantaged than the overall population of 10th graders in the United States in 1990. At the school level, the data show considerable variation in the characteristics of high schools. For instance, schools vary widely in the proportion of minority students they enroll, in the mean SES of their students, in the variation or heterogeneity of the SES of their students, and in the academic background of their students. These data confirm the claim that secondary schools in the United States are highly segregated, not only in racial terms, but in terms of family and academic background.

Models and Statistical Techniques

Modeling the effects of both student-level and school-level variables on any type of student outcome presents formidable conceptual and methodological problems (Bryk and Raudenbush 1992). Over the past decade, statistical techniques have been developed to estimate such models, which are known as multilevel or hierarchical linear models (HLMs). To date, most HLMs have been restricted to analyzing continuous outcomes, such as test scores. But recently, HLMs have been extended to include hierarchical generalized linear models (HGLMs), which provide more appropriate estimates for dichotomous dependent variables, such as dropout and turnover rates (Bryk, Raudenbush, and Congdon 1996).

Multilevel modeling allows researchers to model student-level outcomes within schools, known as *within-school models,* and then to identify and model any between-school differences that arise, known as *between-school models*. This modeling is done by using the estimated parameters from the within-school model as dependent variables in the between-school model. Because the within-school model may contain a number of parameters, each parameter produces its own between-school equation. Each equation can contain both fixed and random effects. In most applications, a series of HLM models are estimated that begin with relatively simple models and additional parameters to develop more complete models. This is the approach we took in this study.

Null Model The first model had no predictor variables in either the within-school or between-school model and is known as a null or one-way ANOVA model. For dichotomous outcomes, it is necessary to specify both a within-school sampling model and a within-school structural model (Bryk, Raudenbush, and Congdon 1996:Chap. 6). For binary student outcomes, the sampling model is Bernoulli:

$$\text{Prob}\,(Y_{ij} = 1 | \beta_j) = \Phi_{ij}. \qquad (1.1)$$

For a null model, the within-school structural model is

$$\log [\Phi_{ij} / (1-\Phi_{ij})] = \beta_{0j}, \quad (1.2)$$

And the between-school structural model is

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (1.3)$$

Under the null model, the expected probability of a student *ij* dropping out or leaving school for a given random school effect, u_{0j}, would be

$$E(Y_{ij} \mid u_{0j}) = 1 / [1 + \exp\{-(\gamma_{00} + u_{0j})\}]. \quad (1.4)$$

The expected probability for a given school is its dropout or turnover rate. This model was used to provide a measure of *estimated* dropout and turnover rates for the sample schools.[15]

Unconditional Model The second model introduced a series of student-level predictors to the within-school model based on the conceptual model and literature review. This model estimated the effects of student-background characteristics on dropping out and turnover:

$$\log [\Phi_{ij} / (1-\Phi_{ij})] = \beta_{0j} + \beta_{1j}\text{Female}_{ij} + \beta_{2j}\text{Asian}_{ij} + \beta_{3j}\text{Black}_{ij} + \beta_{4j}\text{Hispanic}_{ij} + \beta_{5j}\text{Native}_{ij} + \beta_{6j}\text{SES} + b_{7j}\text{Nontraditional}_{ij} + \beta_{8j}\text{Sibdrop} + \beta_{9j}\text{Retained} + \beta_{10j}\text{Remedial} + \beta_{11j}\text{New student} + \beta_{12j}\text{SES missing} \quad (2.2)$$

The between-school structural model in this case contains no school-level predictors:

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (2.2)$$

$$\beta_{pj} = \gamma_{p0},\ p = 1 \text{ through } 12 \quad (2.2)$$

All the equations except the one for the intercept term were "fixed" ($u_{pj} = 0$) so that the effect of the within-school predictors was constrained to be the same for all schools (Bryk and Raudenbush 1992:55–56). In addition, all the student-level variables were centered around their respective grand means, so that the intercept term can be interpreted as an *adjusted* dropout or turnover rate or the expected dropout or turnover rate for "average" students—those with mean characteristics for the entire sample (Bryk and Raudenbush 1992:55–56). This is a useful feature of HLM because it allows one to see how much of the observed differences in school performance can be attributed to differences in students, not differences in features of the schools themselves.

Conditional Models The remaining models introduced a series of school-level predictors to explain between-school differences in adjusted dropout and turnover rates. This first between-school model, known as the student composition model, introduced student composition variables and took the form:

$$\beta_{0j} = \gamma_{00} + \Phi_{01} STUCOMP_j + u_{0j}. \quad (2.3)$$

As in the case of the student-level predictors, the student composition variables were also centered around their grand means, which again altered the intercept term to produce a second adjusted school dropout and turnover rate, this time assuming that schools had the same composition of students. The remaining school-level variables were introduced sequentially, with only the significant variables from the proceeding step retained in the subsequent model. The complete between-school model took the form:

$$\beta_{0j} = \gamma_{00} + \Phi_{01} STUCOMP_j + \Phi_{02} RESOURCES_j + \Phi_{03} STRUCT_j + \Phi_{04} PROCESSES_j + u_{0j}, \quad (2.4)$$

All the remaining school-level variables were not centered because they were considered attributes of the schools themselves, rather than of the students the schools served.

The nonlinear version of HLM used in this study produces three types of estimated coefficients (Bryk et al. 1996:123–131). The first, referred to as the unit-specific estimate, provides an estimate of the expected outcome assuming no random school effects. That is, school dropout and turnover rates are assumed to be a function of only the variables in the model, with no allowance for unmeasured school effects. The second, referred to as the population-average estimate, provides an estimate of the expected outcome averaged over all possible random school effects. The third is referred to as the population-average estimate with robust standard error, which provides the same estimated parameters as in the second type but adjusts the standard errors to provide a more accurate test of significance. The latter are reported in this article because they provide the most appropriate way to examine the "average" outcomes among the population of schools in the HSES sample.

But we also used the unit-specific estimates to explore the distribution of mean dropout

and turnover rates among all the schools in the HSES sample by adding each school's unit-specific estimate to an empirical Bayes estimate of each school's random effect. We produced two sets of unit-specific estimates. The first, based on the null model, were used to examine the distribution of *estimated* dropout and turnover rates of the HSES schools without controlling for differences among schools. The second, based on the student composition model with grand-mean centering, were used to examine the distribution of *adjusted* school dropout and turnover rates—that is, dropout and turnover rates adjusted for differences in student background characteristics and school composition.

RESULTS

We present the results in three parts. First, we present summary statistics of estimated dropout and turnover rates for the entire sample of HSES high schools. Second, we present estimates from models that explain differences in dropout and turnover rates among schools. Third, we compare estimated and adjusted rates to determine the extent to which differences in dropout and turnover rates among schools can be attributed to differences in the characteristics of students who attend schools and to differences in other school characteristics.

Distribution of Dropout and Turnover Rates

The purpose of this study was not only to examine average differences in dropout and turnover rates among schools, but to explore the distribution of dropout and turnover rates among schools. To examine the distribution, we computed an estimated dropout and turnover rate for every school in the HSES sample based on the estimated values of the parameters from the models and an estimate of each school's unique contribution to the dropout or turnover rate.[16] Summary statistics for estimated dropout and turnover rates for the HSES sample of high schools are shown in Table 2.

The mean estimated dropout rate for the overall HSES sample was 7.3 percent. That is, 7.3 percent of the students who attended an "average" urban and suburban high school in 1990 dropped out between the 10th and 12th grades. The figure is higher than the 5.6 percent dropout rate that was estimated for all 10th graders in the United States based on the entire NELS (McMillen, Kaufman, and Klein 1997, Table X).[17] The median dropout rate in the 247 HSES schools is 4.2 percent, which is considerably lower than the mean rate of 7.3 percent. This finding suggests that the distribution of dropout rates is positively skewed.

This skewness can be observed in the boxplots of estimated dropout and turnover rates shown in the first and third columns of Figure 2.[18] The boxplots show that the estimated dropout rates for individual schools ranged from a low of just over 1 percent to over 40 percent. They also show that most high schools in 1990 had relatively modest dropout rates—75 percent had a two-year dropout rate of less than 10 percent. But some rates were extremely high. These fig-

Table 2. Estimated Dropout and Turnover Rates for HSES High Schools, 1990–92 (N = 247)

	Dropout Rate	Turnover Rate
Mean	7.3	20.4
Median	4.2	18.6

Note: Dropout rates are the proportion of students who were enrolled in high school as 10th graders in 1990, but were identified as dropouts in 1992. Turnover rates are the proportion of students who were enrolled in high school as 10th graders in 1990, but were not enrolled in the same school in 1992. Estimated rates were derived from a one-way ANOVA model using nonlinear HLM unit-specific empirical Bayes residual estimates for each school.

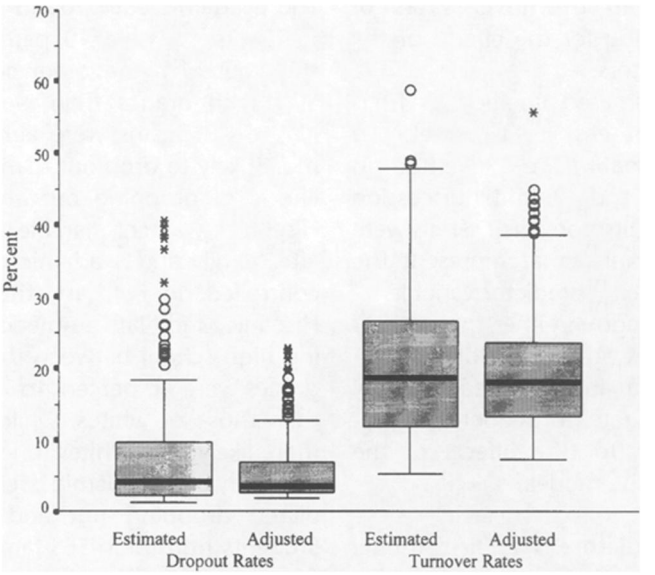

Figure 2. Distribution of Estimated and Adjusted School Dropout and Turnover Rates for the Entire Sample of Schools.

Note: Estimated rates were derived from a one-way ANOVA model and unit-specific empirical Bayes residual estimates for each school. Adjusted rates were derived from a fixed coefficient model controlling for student background characteristics and student composition centered on the grand mean and unit-specific empirical Bayes residual estimates for each school.

ures support previous reports of high dropout rates in large, urban school systems (Hammack 1986). But they also indicate that the dropout problem is concentrated in a relatively small proportion of high schools, which supports the proposition that the general malaise attributed to American schools is probably concentrated in relatively few schools (Berliner and Biddle 1995).

School turnover rates also vary widely among schools. The mean turnover rate of urban and suburban high schools in 1990 was 20.4 percent. That is, 20.4 percent of the students who attended an "average" urban and suburban high school in 1990 left that school between the 10th and 12th grades. This result demonstrates that student turnover is a sizable problem among U.S. high schools—the average or median high school "lost" 19 percent of its 10th graders in two years. Turnover rates were less skewed than dropout rates, as reflected in the similarity between the mean and median rates. But they still varied widely among schools, ranging from a low of 5 percent to a high of almost 60 percent. There was even more variability in school turnover rates than among school dropout rates. If turnover rates measure schools' holding power, then schools vary widely in their ability or willingness to educate all their students.

The correlation between estimated dropout and turnover rates was .572. This finding suggests that the two outcomes are clearly related, but also represent two distinct phenomena, as the literature suggests.

Differences in Dropout and Turnover Rates

What explains differences in school dropout and turnover rates among schools? We estimated a series of statistical models to examine the effects of two types of factors on dropout and turnover rates: student-level factors and school-level factors. The first model estimated the effects of a series of student-level predictors on dropping out and leaving school. The remaining models estimated the effects of various school-level predictors on

average dropout and turnover rates of schools after adjusting for the effects of the student-level predictors.

Because the estimated coefficients from the models are not easy to interpret, the entire set of estimates are presented in Appendix Tables A1 and A2. In the discussion that follows, the results from the models were transformed into figures that represent the effect of each significant predictor variable on the percentage change in either the odds of dropping out or leaving school (for student-level predictors) or in the mean school dropout or turnover rate (for school-level predictors), controlling for the effects of the other predictors in the model.[19]

Student-Level Predictors The first model estimated the effects of student-level predictors on dropout and turnover. Table 3 shows the estimated effects of a one-unit increase in the significant student-level predictors on the odds of dropping out or leaving school.[20]

The results show that some ethnic minorities are more likely than whites to drop out or leave the high school they attended in the 10th grade even after differences in family and academic background are controlled. In 1990, Asians were 50 percent less likely to drop out of high school between the 10th and 12th grades than were whites, while Native Americans were almost 100 percent more likely to drop out than whites. The likelihood of dropping out among blacks and Hispanics was comparable to that of whites after family and academic background were controlled. In contrast, the odds of black, Hispanic, and Native American students leaving high school between the 10th and 12th grades were 40 percent to 70 percent higher than those of whites, while Asians were no more likely than whites to leave school.

Family and academic background also predicted dropping out and leaving school. Students from high-SES families were almost 50 percent less likely than students from average-SES families to drop out of high school. Although not shown in the table, the results also suggest that students from low SES-families were about twice as likely than students from average-SES families to drop out of high school. Students from nontraditional families and from families in which a sibling dropped out of school were more likely than other stu-

Table 3. Percentage Change in Odds of Students Dropping Out or Leaving School Between the 10th and 12th Grades Because of Changes in Students' Characteristics

Students' Characteristics	Dropping Out	Leaving School
Demographic Characteristics		
Asian	-56.0	—
Black		41.2
Hispanic		39.0
Native American	94.1	68.9
Family Background		
Socioeconomic status	-45.3	-12.6
Nontraditional family	67.7	83.5
Sibling dropped out	62.9	42.8
Academic Background		
Retained in Grades 1–8	37.9	51.8
Remedial classes Grades 9–10	50.2	46.9

Note: Figures represent the change in the odds ratios, expressed as a percentage change, because of a one-unit increase in the value of each predictor variable controlling for all other student-level variables in the model.

Source: Appendix Tables A1 and A2.

dents to drop out of high school, as were students who had been retained or who were taking remedial classes in high school.

The same family and academic background variables also predicted whether students left their 10th-grade schools. Family SES had a relatively modest effect on student turnover compared to its effect on student dropout: Students from high-SES families were only 13 percent less likely than students from middle-SES families to leave their 10th-grade schools. This finding suggests that student mobility is fairly common among students from all socioeconomic levels, but student dropout is not.

The results of the within-school models revealed that both dropping out and leaving school are influenced by a common set of student and family characteristics; in general, both activities are more common among low-achieving students from lower-class and unstable families. These findings are consistent with two other empirical studies that contrasted dropout and mobility (Lee and Burkam 1992; Rumberger and Larson 1998). Together, this research supports the proposition that there are similarities between the act of dropping out of school or leaving a particular school, as theories of dropping out and institutional departure suggest (Tinto 1987; Wehlage et al. 1989).

School-Level Predictors The remaining models examined the effects of school-level predictors on adjusted school dropout and turnover rates. Table 4 shows the estimated effects of a one-unit increase (for dichotomous variables) or a one-standard-deviation increase (for continuous variables) on the percentage change in average school dropout and turnover rates, controlling for variables from the preceding models.

The second model examined the impact of student composition variables. The results show that high-SES high schools had 40 percent lower dropout rates than did average-SES high schools, even after differences in the background characteristics of students and differences in other school-level predictors were controlled.[21] Conversely, low-SES high schools had dropout rates about 60 percent higher than average-SES high schools.[22] Schools with greater proportions of academically at-risk students, as measured by the percentage of students in the schools who were retained in Grades 1–8, also had higher dropout rates.

School turnover rates were influenced by somewhat different student composition variables. The percentage of at-risk students had similar impacts on turnover rates as it did on dropout rates. But mean SES did not influence school turnover rates. The most powerful predictor of turnover, however, was the ethnic composition of the school. Schools in which more than 40 percent of the students were black or Hispanic had turnover rates that were more than 50 percent higher than comparable schools with lower concentrations of these minority students. Similar results were found in studies of middle school dropouts (Rumberger 1995) and high school test scores (Lee and Bryk 1989). This finding is consistent with the conclusions of several case studies of large, urban minority schools that experienced extremely high student turnover, in part, because of active attempts by the school staff to get rid of difficult students (Bowditch 1993; Fine 1991; Hess, Wells, Prindle, Liffman, and Kaplan 1986).

The third model examined the impact of school resources. Schools with higher student-teacher ratios had higher adjusted dropout rates than did schools with average student-teacher ratios. And schools with higher teacher salaries had lower adjusted dropout rates than did schools with average teacher salaries. Both these results suggest that financial resources matter for this measure of school performance. The results suggest that the quality of teachers also matters. Schools in which students report a higher quality of teachers have lower adjusted dropout rates than do schools in which students report an average quality of teachers. However, schools in which principals report a higher percentage of excellent teachers have higher adjusted dropout rates. Although these two findings appear contradictory, they may reveal different notions of high-quality teachers as expressed by students and principals. In the eyes of students, good teachers may mean understanding and supportive teachers who can contribute to students stay-

Table 4. Percentage Change in Mean School Dropout and Turnover Rates for 10th-Grade Students Because of Changes in School Characteristics

School Characteristics	Dropout Rate	Turnover Rate
Composition		
Mean socioeconomic status	38.6	—
Percentage retained, Grades 1-8	15.5	20.0
High minority	—	49.0
Resources		
Mean teacher quality	-14.4	-13.9
Student-teacher ratio	15.6	—
Percentage of excellent teachers	14.5	—
Mean teacher salary	—	-12.1
Structural		
Catholic	-74.3	—
Other private	-61.2	52.3
Size	-15.1	—
Urban	-29.3	—
Processes		
Attendance	-25.5	—

Note: Figures represent the approximate percentage change in mean school dropout or turnover rates that are due to a one-standard deviation increase (for continuous measures) or a one-unit increase (for dichotomous measures) in the predictor variable, controlling for effects of other variables in the model.

Source: Appendix Tables A1 and A2.

ing in school, whereas in the eyes of principals, excellent teachers may reflect tough academic standards or strict disciplinary practices that contribute to some students quitting school. In addition, the students' reports of the quality of teachers referred to the teachers that the 10th-grade students actually had in school, while the principals' reports referred to all the teachers in the respective schools.

The fourth model examined structural variables. The results suggest that a number of structural factors explained differences in school mean dropout rates, but few of these factors explained differences in school mean turnover rates. Both the Catholic schools and other private schools had significantly lower adjusted dropout and turnover rates than did the public schools, a finding consistent with previous studies of high school dropout rates based on an earlier sample of U.S. high schools (Bryk et al. 1993; Bryk and Thum 1989; Coleman and Hoffer 1987). At the same time, there were no differences between the public and Catholic schools in student turnover rates, which is consistent with an earlier study of student transfers that found that students who left Catholic schools were more likely to transfer to public schools, whereas students who left public schools were more likely to drop out (Lee and Burkam 1992). In contrast, students in other private schools were more likely to leave school after differences in student composition and other structural factors were controlled. In other words, private schools have no greater holding power than have public schools even if they do have much lower dropout rates. Two other structural characteristics also predicted dropout rates: Larger schools actually had lower adjusted dropout rates than did smaller schools, and urban schools had lower adjusted rates than did suburban schools.

The final model examined the impact of school-process variables. Few of these variables had a significant impact on school dropout and turnover rates after the effects of other variables in the models were controlled

(see Appendix Tables A1 and A2). As Table 3 shows, schools with higher attendance rates had lower adjusted dropout rates than did schools with lower attendance rates—a one-standard-deviation increase in school attendance (from a mean of 92 percent to 98 percent) decreased adjusted school dropout rates by 25 percent. Previous studies found that attendance or absenteeism is a strong predictor of dropout at the student level (Rumberger 1995; Rumberger and Larson 1998), which may reflect students' engagement in school, so it is not surprising that a school-level measure of attendance predicted school dropout rates. Yet this was the only school-process variable that remained a significant predictor of school dropout rates after student background, student composition, resources, and structural features of schools were controlled. Previous studies found a number of school-process variables to be significant predictors of school dropout rates, including academic and social climate (Bryk and Thum 1989; Rumberger 1995), although these studies did not include a school-level measure of attendance.

Even more surprising, none of the school-process variables predicted differences in adjusted school turnover rates after differences in student background, student composition, resources, and structural variables were controlled. Of course, these factors were highly correlated. For example, the mean SES of a school was strongly correlated with average daily attendance (.53), teachers' engagement or locus of control (.54), and the percentage of students in an academic track (.61). So adjusting dropout and turnover rates for differences in student composition understates the contribution that school-process variables can make to dropout and turnover rates.

The amount of variance in dropout and turnover rates explained by the various models is shown in the bottom parts of Appendix Tables A1 and A2. The within-school model explained a large percentage of the estimated variability among schools—39 percent of the variance in dropout rates and 36 percent of the variance in turnover rates. Thus, a substantial portion of the variability in school dropout and turnover rates can be attributed to differences in the distribution of students among schools. Differences in student composition also helped explain differences in dropout and turnover rates—44 percent of the variance in dropout rates and 55 percent of the variance in turnover rates could be attributed to the joint effects of student background and student composition. The final between-school model increased the total amount of explained variance in dropout rates to 57 percent and increased the total amount of explained variable in turnover rates to 59 percent.

The amount of variance explained by the final model is higher than two previous HLM studies of school dropout rates. A study using similar models and the same nonlinear HLM program as in this study was able to explain 42 percent of the variance in mean dropout rates among middle schools (Rumberger 1995, Table 4). An earlier study based on the High School and Beyond data set using linear HLM analysis was able to explain 40 percent of the variance in mean dropout rates among high schools (Bryk and Thum 1989, Table 7).

Estimated versus Adjusted Rates

The preceding analysis revealed that student background and student composition explained a substantial amount of the variability in dropout and turnover rates among schools. This analysis suggests that the high dropout and turnover rates observed in some high schools may be due, in large part, to the high proportion of students from disadvantaged backgrounds who are more prone to dropout or leave school because of individual and family circumstances. As a result, it is unfair to compare observed or actual performance of schools. Instead, schools should be compared on how well they perform with similar types of students.

To investigate this issue, we computed an adjusted dropout and turnover rate for every school in the HSES sample. The adjusted rates assume that all the schools enrolled the same "average students," that the effects of student background characteristics on dropping out and leaving school were the same across all the schools, but that the effects of student composition varied from school to school. To

illustrate the impact of this procedure, Figure 3 shows the estimated (or actual) and adjusted dropout rates for four schools in the HSES sample and how these values compared to the sample means.

The figures show that, indeed, adjusting for differences in student background and composition reduces the expected dropout rates for the worst-performing schools. For example, the dropout rate for school 86287 falls from an estimated value of 41 percent to 24 percent. Thus, if this school enrolled "average" students, its dropout rate would be about 24 percent instead of the actual (estimated) 41 percent. Adjustments for several other schools are also shown, along with the mean values for the entire sample of schools. Adjusting for differences in student composition reduces the mean dropout rate from 7.3 percent to 4.9 percent.

Boxplots for the entire distributions of both adjusted dropout rates and adjusted turnover rates are shown in Figure 2. The figures reveal that some, but not all, of the variability in school dropout and turnover rates in this sample of schools can be attributed to differences in the characteristics of students who attend them. Adjusting for differences in student characteristics reduced the extremely high dropout rates of the worst-performing high schools. Despite these adjustments, however, these schools remained poor performing. That is, even if poor-performing high schools had better or average students, our estimates suggest they would still be characterized as poor performing.

Although adjustments for student background characteristics greatly reduced the dispersion in school dropout rates, they had much less effect on the dispersion in turnover rates. The mean estimated turnover rate for all the schools was 20.4 percent, while the mean adjusted rate was only a somewhat lower 17.8 percent. Recall that student background and composition factors actually explained more of the variance in turnover rates than among dropout rates. Yet even with such adjustments, considerable variability in school turnover rates remained simply because there was more variability in the first place. In particular, even after differences in student characteristics were adjusted for, some schools would still have extremely high turnover rates. This finding further suggests

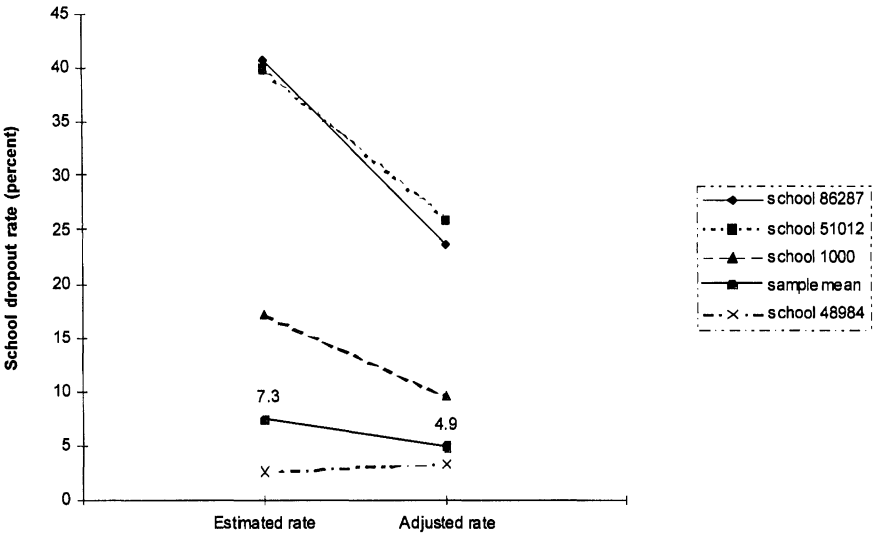

Figure 3. Estimated and Adjusted Dropout Rates for Selected Schools and Mean for Entire Sample of Schools

Note: Estimated rates were derived from a one-way ANOVA model and unit-specific empirical Bayes residual estimates for each school. Adjusted rates were derived from a fixed coefficient model controlling for student background characteristics and student composition centered on the grand mean and unit-specific empirical Bayes residual estimates for each school.

that school turnover rates may provide an important measure of school performance in terms of how well schools are retaining their students.

CONCLUSION

This study examined the distribution of dropout and turnover rates among a sample of 247 high schools from urban and suburban areas in the United States. We focused on both of these measures partly because school turnover rates—the proportion of entering students who leave before graduation—may provide another, more complete measure of a school's effectiveness than simply looking at students who drop out. A growing body of research suggests not only that student turnover is harmful to both students and schools, but that schools are able to do something about it.

This study provided a detailed look at dropout and turnover rates at the high school level. Three important findings emerged. First, turnover rates were higher and varied more widely among high schools than did dropout rates. The dropout rate for the "average" high school, as expressed by the median rate, was a modest 4.2 percent, and more than three-quarters of the high schools had two-year dropout rates of under 10 percent. Only a relatively small proportion of the public high schools (8 percent) had dropout rates of over 20 percent, or five times the national average. Turnover rates, however, were much higher, averaging 19 percent for the typical high school. And more than a quarter of the high schools "lost" at least 25 percent of their 10-grade students over a two-year period. This finding supports the growing body of research that shows that student turnover or mobility is widespread in American schools (Kerbow 1996; Rumberger and Larson 1998; Swanson and Schneider 1999; U.S. General Accounting Office 1994).

Second, a substantial amount of the variation in school dropout and school turnover rates was attributable to differences in the characteristics of students who attended the schools because schools vary widely in the types of students they enroll and student background characteristics have a large impact on student dropout and turnover. Virtually all national studies of school effectiveness have arrived at similar conclusions. We also found that the composition of students in a school influenced dropout and turnover rates beyond the individual effects of student background. Although the concentration of academically at-risk students had similar impacts on dropout and turnover rates, other composition variables did not. The social-class composition of schools had a strong effect on school dropout rates, but not on turnover rates, whereas ethnic concentration had an impact on turnover rates, but not on dropout rates. In particular, schools with high concentrations of minority students had substantially higher turnover rates than did those with low concentrations even after differences in student background and the academic makeup of the student body were controlled. Altogether, student background and composition explained 44 percent of the variance in dropout rates among schools and 55 percent of the variance in turnover rates.

Third, schools exert a powerful influence on students' achievement. Although about half the variability in dropout and turnover rates could be attributed to student characteristics, the remaining half could not and thus is probably due to the influence of schools themselves. Our analysis revealed that a number of measures of school resources, school structure, and school processes affected dropout rates, including the student-teacher ratio, the quality of teachers, school control, size, and average daily attendance. But only a few of these factors predicted turnover rates. Overall, more of the variability in turnover rates could be attributed to the impact of student composition, while more of the variability in dropout rates could be attributed to the impact of school resources, school structure, and school processes.

The results of this study provide support for both research perspectives that have been used to study school dropout rates in the past. The first perspective is based on the school effectiveness literature, which suggests that all student outcomes—including test scores, dropout rates, and turnover rates—are influenced by a common set of

characteristics that promote the overall effectiveness of schools. Our findings that student dropout and turnover rates were associated with such factors as school resources and school structure lend support for this perspective.

At the same time, we found that these factors were unable to explain all the variability among school dropout and turnover rates. This finding provides at least indirect support for the other perspective, the school dropout perspective. This perspective suggests that schools and the people in them make deliberate decisions to discharge students, either as dropouts or transfers, partly on the basis of external demands that are being placed on them. These actions can be explained both by the desire for technical efficiency and by the need for institutional legitimacy. Although qualitative studies have demonstrated how technical and institutional behavior leads to students being discharged from school, it has been difficult to verify the independent effects of these factors in large, quantitative studies such as ours. Nonetheless, there is sufficient evidence that schools contribute to student dropout and turnover that this area of research should continue to be pursued in the future.

The results of this research have implications for current policy initiatives on school performance and accountability. A number of states and districts around the United States, including Chicago, Texas, and California, are developing indicators of school performance to identify low-performing schools and target them for intervention (Bryk, Thum, Easton, and Luppescu 1998; California State Board of Education 1999; Texas Education Agency 1997). Indicators of school performance typically include measures of students' test scores and high school graduation rates. But until recently, student mobility or turnover was not considered. Now there is a growing realization that mobile students can adversely affect students' test scores and that the schools that accept such students should not initially be accountable for students' test scores. As a result, states, such as Texas and California, do not include the test scores of students who have been enrolled in a school for less than a year in a school's performance index (California State Board of Education 1999; Texas Education Agency 1997).

But if schools are not going to be accountable for students who enter late, our results suggest they should be accountable for students who enter early. According to our estimates, up to half the variability in high school turnover rates can be attributed to the characteristics of schools. Thus, schools could be rated on how well they retain and graduate their students. Colleges and universities are rated, in part, on the retention and graduation rates for entering freshman cohorts (U.S. News and World Report 1996). High schools could be rated in a similar fashion. If they were, high schools would likely make more of an effort to reduce student turnover, which current research suggests would improve the overall achievement of students.

NOTES

1. Although they are generally treated as intervening variables, they can also be considered as outcomes (Willms 1992).

2. Two studies of high schools (Gamoran 1996; Lee et al. 1997) were based solely on NELS students, which resulted in within-school samples of 10 to12 students per school.

3. The decision to restrict the geographic range of HSES schools limits comparisons with an earlier study of high schools, High School Beyond, which included a sample of over 1,000 high schools from all areas of the country in 1980. In particular, HSES provided restricted coverage of suburban schools and little or no coverage of the large number of schools located in rural areas (Witte 1992, Table 8).

4. In the unweighted HSES sample, for example, 55 percent of the schools were urban, 28 percent enrolled more than 2,000 students, and 44 percent enrolled more than 50 percent minority students. In the weighted sample, 35 percent of the schools were urban, 14 percent enrolled more than 2,000 students, and 37 percent enrolled more than 50 percent minority students.

5. The school-level weights adjusted for the unequal probabilities of selection and for

refusal to participate in HSES, but not for nonresponse to the school questionnaire (L.A. Scott et al. 1996:39).

6. Because the school sampling was highly complex, NCES provided three different school-level weights in the data set that produced different estimates of school-mean dropout rates: The weighted sample mean of the within-school-sample dropout rate based on the school weight, S1SCQWT1, was 7.1 percent, while the value based on the school weight, S1SCQWT3, was 7.8 percent. Moreover, the school-level weights had a wide range, which produced highly unstable estimates of school-level predictors of dropout and turnover rates. The weights ranged from a low of 1 to a high of 360. That is, one school in the HSES sample represents one high school in the population of schools found in the 30 largest MSAs in the United States, while another school in the sample represents 360 high schools. Finally, the multilevel modeling program (HLM) used in this study did not permit weighting at the student level.

7. We produced some weighted estimates to see how they compared to our unweighted estimates. First, we estimated the student background (within-school) model described later using logistic regression and the within-school student-level weight (S1STSCWT). The resulting estimates were similar to those produced using HLM with unweighted data. Second, we estimated the preliminary (null) model using the school weight (S1SCQWT1) recommended by NCES (L.A. Scott et al. 1996:39). This estimate produced an average school dropout rate of 7.2 percent, which compared favorably to the 7.3 percent rate reported later.

8. Only 3 percent of the sample (272 students), for example, were missing data on student SES. These respondents were assigned the mean SES for the sample (.21) and given a flag indicating they were missing SES. We also included all responding schools (247), which resulted in schools with missing data. If a school was missing any school-level variable, it was given the mean value if the variable was continuous and zero if the variable was a dummy. We also created a school missing variable flag for schools that were assigned missing data. We included the flag variable in the regressions to see if it changed the results and found that it did not.

9. It can also be conceptualized at more than two levels, including classrooms and districts. See (Willms 1992) for a more detailed discussion.

10. In the sample, 5.3 percent of the core NELS students versus 8.1 percent of the augmented students were identified as dropouts.

11. The academic background variables measured students' academic performance prior to the start of high school in the 9th or 10th grade. Students are typically placed in remedial courses in Grades 9 and 10 because of their lack of preparation for high school, not as a result of their performance after they start high school. Thus, we thought it was an adequate "background" measure. Moreover, it has been used in these other studies for the same purpose. A related variable, whether a student was over age 16 in the 10th grade, has also been shown to predict both student transfer and dropout (Lee and Burkam 1992).

12. Two earlier studies (Bryk and Thum 1989; Rumberger 1995) found that schools with high concentrations of minority students had lower student performance.

13. Student-level data were weighted in computing the school-level aggregated values using the within-school student weight (S1STSCWT) provided by NCES.

14. The teacher variables were the same ones used in several other studies of teachers in high schools (Lee, Dedrick, and Smith 1991; Lee, Smith, and Cioci 1993). The variables were subject to a factor analysis, which yielded six factors related to perceptions of principal leadership, control over classroom policies, collegiality, influence over school policy, and chair and administrative support.

15. These estimates provide a more accurate measure than the observed rates based on the within-school samples because they adjust for sampling variance (Bryk and Raudenbush 1992:61-64).

16. The school contribution is an empirical Bayes estimate produced by the HLM program that takes into account the varying precision of individual school rates that are due to differences in the size of the within-school student samples (see Bryk and Raudenbush 1992:124-125).

17. The estimated dropout rate of the population of 790,504 students attending high school within the 30 MSAs from which the HSES schools were selected was 8.2 percent (based on the student sample weight S1QWT3), which further suggests that dropout rates were higher within the 30 MSAs than in the United States overall.

18. The top of the box in each plot represents the value for the 75th percentile of the distribution, the bottom of the box represents the 25th percentile of the distribution, and the dark line in the middle of the box represents the 50th percentile or median of the distribution. The "whiskers" represent those values that fall within range of 1 1/2 times the length of the box and are considered within a "normal" range. Individual values that lie outside the whiskers are considered outliers and are marked individually.

19. The figures reported in the graphs are odds ratios expressed as percentage changes. Because the estimated effects of the predictor variables in nonlinear models depend on the values of all other coefficients in the model, it is customary to transform (e^b) them into odds ratios, which are not dependent on the values of the other variables in the model. Odds ratios represent the ratio of the predicted odds $[p/(1-p)]$ of dropping out or leaving school that are due to a one-unit increase in the independent variable versus the predicted odds without the one-unit increase, controlling for the effects of the other variables in the model. Thus, a value of 1 signifies no change in the odds, a value greater than 1 indicates an increase in odds, and a value less than 1 indicates a decrease in odds. We computed odds ratios based on an increase of one standard deviation in the value of the independent variable for continuous variables or based on a one-unit increase in the value of the independent variable for dichotomous variables. We then expressed them as percentage changes, so that an odds ratio of 2 is expressed as a 100 percent increase (twice the odds) and an odds ratio of .5 is expressed as a 50 percent decrease (half the odds).

20. Although in some cases we note differences in the size of these effects, we did not test whether the differences were significant.

21. Because the odds of dropping out or even leaving school are relatively low (between 7 and 20 percent), odds ratios are approximately equal to percentage changes in school mean dropout or turnover rates $\{[p_2/(1-p_2)]/[p_1/(1-p_1)] \text{ ¿ } p_2/p_1\}$. For example, a one-standard- deviation increase in mean SES decreases the odds of dropping out by .61 or 39 percent. A one-standard-deviation increase in mean SES decreases the mean dropout rate of schools from 4.36 percent to 2.72 percent, a decrease of 38 percent. Because we are interested in estimating the impact of school-level predictors on mean school dropout and turnover rates, we refer to changes in odds ratios as changes in school means.

22. The inverse of the odds ratio of .61 (a 39 percent decrease) is 1.63 (a 63 percent increase).

APPENDIX TABLE A1

HLM Dropout Estimates

	Student Model	Composition Model	Resource Model	Structure Model	Process Model
Average base rate	-2.992*	-3.088	-3.152	-2.552	2.020*
Composition					
Mean socioeconomic status (SES)	—	-0.857	-0.806	-0.630*	-0.444‡
Percentage retained, Grades 1–8	—	1.215	1.394‡	0.999†	1.239‡
Resources					
Mean student-teacher ratio	—	—	0.029	0.040‡	0.051*
Mean teacher quality	—	—	-0.380	0.036	0.092
Percentage of excellent teachers	—	—	0.588	0.549†	0.630‡
Structural Characteristics					
Catholic school	—	—	—	-1.360*	-1.224*
Other private school	—	—	—	-0.946*	-1.002*
Urban school	—	—	—	-0.347†	-0.568*
School size (/100)	—	—	—	-0.017†	-0.020‡
Process-Climate					
Average daily attendance	—	—	—	—	-4.916*
School controls					
Missing school data	—	—	-1.748	-1.616‡	-1.571*
Student-Level Controls					
Asian	-0.822*	-0.812*	-0.822*	-0.833*	-0.835*
Native American	0.663*	0.657‡	0.645‡	0.603†	0.608†
SES	-0.604*	-0.445*	-0.446*	-0.451*	-0.452*
Nontraditional family	0.517*	0.485*	0.487*	0.475*	0.468*
Retained in Grades 1–8	0.321*	0.266‡	0.270	0.266‡	0.267‡
Sibling dropped out	0.488*	0.468*	0.463*	0.466*	0.464*
Remedial courses, Grades 9–10	0.407*	0.410*	0.398*	0.408*	0.412*
New survey student	0.621*	0.586*	0.593*	0.618*	0.615*
Missing SES	1.465*	1.404*	1.437*	1.435*	1.414*
Variance component	0.831	0.763	0.733	0.638	0.586
Variance explained	0.389	0.439	0.461	0.531	0.569
Reliability	0.595	0.544	0.526	0.481	0.460

*Significant at .01, ‡ significant at .05, † significant at .10.

APPENDIX TABLE A2

HLM Turnover Estimates

	Student Model	Composition Model	Resource Model	Structure Model	Process Model
Average School Rates					
Base rate	-1.560*	-1.568*	-1.582*	-1.656*	-1.656*
Composition					
Percentage, new survey students	—	0.445‡	0.385†	0.507‡	0.507‡
High minority	—	0.399‡	0.385*	0.498*	0.498*
Percentage retained, Grades 1-8	—	1.537*	1.411*	1.487*	1.487*
Resources					
Mean teacher quality	—	—	-0.365*	-0.517*	-0.517*
Mean teacher salary	—	—	-0.020‡	-0.014	-0.014
Structural Characteristics					
Other private	—	—	—	0.421†	0.421†
Process-Climate					
	—	—	—	—	—
Student-Level Controls					
Black	0.306*	0.144	0.150	0.153	0.153
Hispanic	0.248	0.136	0.162	0.167	0.167
Native American	0.503	0.440†	0.432†	0.441†	0.441†
Socioeconomic status (SES)	-0.249*	-0.192*	-0.181*	-0.197*	-0.197*
Nontraditional family	0.597*	0.592*	0.588*	0.592*	0.592*
Sibling dropped out	0.333*	0.326*	0.318*	0.322*	0.322*
Retained in Grades 1–8	0.396*	0.357*	0.361*	0.360*	0.360*
Remedial courses, Grades 9–10	0.372*	0.371*	0.367*	0.367*	0.367*
Missing SES	1.895*	1.974*	1.989*	2.000*	2.000*
Variance component	0.356	0.287	0.273	0.261	0.261
Variance explained	0.435	0.545	0.568	0.586	0.586
Reliability	0.598	0.538	0.523	0.513	0.513

*Significant at .01, ‡ significant at .05, † significant at .10.

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