



Teacher Absence as a Leading Indicator of Student Achievement

New National Data Offer Opportunity to Examine Cost of Teacher Absence Relative to Learning Loss

Raegen Miller November 2012



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Introduction and summary

On any given school day, up to 40 percent of teachers in New Jersey’s Camden City Public Schools are absent from their classrooms.¹ Such a high figure probably would not stand out in parts of the developing world,² but it contrasts sharply with the 3 percent national rate of absence for full-time wage and salaried American workers,³ and the 5.3 percent rate of absence for American teachers overall.⁴ Certainly, it isn’t unreasonable for Camden residents to expect lower rates of teacher absence, particularly when the district annually spends top dollar—more than \$22,000 per pupil—to educate its students.⁵ And advocates for students of color, who constitute 99.5 percent of the district’s enrollment,⁶ could potentially use these new data from the Department of Education to support a civil rights complaint.

Beginning in 2009 the Office for Civil Rights in the U.S. Department of Education included a new item on its biennial Civil Rights Data Collection survey—teacher absences.⁷ Notwithstanding concerns about equity, attention to this issue is appropriate for two reasons:

- First, teachers are the most important school-based determinant of students’ academic success. It’s no surprise researchers find that teacher absence lowers student achievement.⁸
- Second, resources are scarce, and any excess of funds tied up in teacher absence, which costs at least \$4 billion annually,⁹ should be put to better use.

This report uses the Civil Rights Data Collection dataset¹⁰ released in early 2012 to raise questions and drive debate about the subject of teacher absence. This dataset comes from the first national survey to include school-level information on teacher absence. The measure constructed from this information is the percentage of teachers who were absent more than 10 times during the year. The Department of Education calls the measure a “leading indicator,”¹¹ a reasonable label given the documented relationship between absence rates measured at the teacher level and student achievement. Yet very little is known about the properties of this new school-level measure.

On average, 36 percent of teachers nationally were absent more than 10 days during the 2009-10 school year based on the 56,837 schools analyzed in the dataset. The percentages reported by individual schools range from 0 percent to 100 percent, with 62 percent of the variation in the measure occurring between districts and a third occurring within districts. The latter statistic is significant because all schools within a given district operate under the same leave policies, and teacher absence levels well above a district average may be a symptom of a dysfunctional professional culture at the building level.

State averages on the novel Civil Rights Data Collection measure of teacher absence range from a low of 20.9 percent in Utah to a high of 50.2 percent in Rhode Island. A ranking of states on page 8 raises questions about the wisdom of some states' teacher absence policies.

This report also notes that teacher absence is yet another item that can be added to the list of ways in which charter schools differ from traditional public schools. Teachers are absent from traditional public schools more than 10 times per year at a rate that is 15.2 percentage points higher than in charter schools.

A school's grade-level configuration provides some indication of its teachers' absence behavior. An average of 33.3 percent of teachers were absent more than 10 days in high schools. The corresponding figures for elementary and middle schools are 36.7 percent and 37.8 percent, respectively. In this sense, this novel measure tracks conventional rates of absence constructed from teachers' daily absence records.¹²

This report also supplies evidence that students in schools serving high proportions of African American or Latino students are disproportionately exposed to teacher absence. Holding constant the grade-level and whether a school is a charter, a school with its proportion of African American students in the 90th percentile has a teacher absence rate that is 3.5 percentage points higher than a school in the 10th percentile. The corresponding differential based on percentages of Latino students is 3.2 percentage points.

With these and other findings, this report seeks to draw attention to the too long-neglected subject of teacher absence. The costs of teacher absence, both in financial and academic terms, can no longer be borne in silence. The abundance of variation in teacher absence behavior, both between districts and within, means that there is room in many districts and individual schools for teachers to have adequate access to paid leave while being absent less frequently.

Admittedly, more research is needed, especially on within-district factors that shape absence behavior, including school leadership and professional norms. Such inquiry, which requires fine-grained absence data tied carefully to other information, can ride on the coattails of data-intensive efforts currently underway to fold student achievement data into performance evaluations of teachers. The federal government engaged in what is fashionably called “data driven decision making” when it introduced teacher absence to the Civil Rights Data Collection survey. Policymakers at lower levels of government can get on board in the following ways:

- State policymakers should revisit statutes governing employees’ leave privileges. All employees should have access to a minimum standard of at least seven paid sickdays per year,¹³ and most teachers are covered by the federal Family and Medical Leave Act, which provides up to 12 weeks of job-protected leave to care for a new child, a seriously ill family member, or to recover from one’s own serious illness. But teachers’ leave provisions in some states may be too permissive, elevating rates of absence and incurring the financial liability of accumulated, unused leave.
- All states should follow the lead of California and New Jersey to ensure that employees have access to family and medical leave insurance to provide income support when a worker has a new child, needs to care for a seriously ill family member, or needs to recover from one’s own serious illness.¹⁴
- Encourage local policymakers to “right-size” leave privileges and initiate incentive policies designed to reduce levels of teacher absence. Many examples of such policies exist and teachers respond to them. The cost associated with smart incentive plans can be covered by the savings realized from reduced absence rates. Improved student achievement would be a likely and desirable side benefit of such initiatives.

Dealing with teacher absence

As employers, school districts must accommodate some level of teacher absence with a combination of policies and management tools. Prominent policies include some number of days of paid leave for illness or personal reasons, and incentives discouraging frivolous use of paid leave. An electronic absence management system that records absences, assigns substitutes, and produces reports is a commonplace management tool.

State policies often set parameters for local policy. Districts in Ohio, for example, must offer teachers at least 15 days of paid sick leave per year.¹⁵ Mississippi, in contrast, sets the floor at seven days.¹⁶ States also set the bar in terms of qualifications for substitute teachers, with some requiring little more than a high school diploma. Others require a baccalaureate degree or even full licensure as a teacher, which is the case in North Dakota.¹⁷

Charter schools, on the other hand, are typically free to operate outside the state parameters, but traditional districts also enjoy latitude around many issues bearing on teachers' absence behavior. Collective bargaining contracts or board policies may specify, for example, the point at which a stretch of absence due to illness requires medical verification, or proscribe the use of personal leave on days adjacent to school holidays.

The drivers of teacher absence

A good deal is known about relationships among teacher absence, relevant policies, and management practices.¹⁸ One would expect, for example, to see higher rates of absence where more paid leave is available and where there's less incentive to take leave frugally.¹⁹ Teachers also tend to be absent less often if they're required to notify their principal of impending absences by telephone.²⁰ Employers and teachers can both benefit from policies that balance paid short-term leave privileges with income insurance for unpaid leave associated with absences covered by the Family and Medical Leave Act.²¹

But policy and management alone don't determine employee behavior. Individual and school-level factors also matter. Female teachers tend to be absent more often than their male counterparts,²² a finding consistent across employment sectors and with links to highly gendered family responsibilities. Teachers who commute long distances—and are therefore more susceptible to bad weather and other obstacles—also tend to be absent more often than teachers with shorter commutes.²³

The costs of teacher absence

Schools spend more on the salary and benefits of teachers than any category of expenditure, so it's not surprising that the financial costs of teacher absence are high. With 5.3 percent of teachers absent on a given day,²⁴ stipends for substitute

teachers and associated administrative costs amount to a minimum of \$4 billion annually. Additional financial costs tied to teacher absence include payouts of accumulated, unused leave and annual awards designed to discourage unnecessary absences. In some states these payout costs come in the form of enhanced lifetime pension benefits.²⁵ A comprehensive cost figure is extremely difficult to calculate, but this does not preclude knowing that the figure is too high.

In addition, districts routinely generate teacher absences themselves by conducting professional development activities during class time. Charter schools are less likely to engage in this practice, but traditional districts tend to see the costs of absence as lower than the costs of lengthening teachers' contract year with a proportional increase in salary. This false dichotomy provides a glimpse of how rigid, traditional compensation systems stifle creative, cost-saving, and strategic thinking.

Likewise, teacher absence has important nonfinancial costs. It negatively affects student achievement, a fact borne out by research that finds that every 10 absences lowers average mathematics achievement equivalent to the difference between having a novice teacher and one with a bit more experience.²⁶ Estimating such effects is challenging, in part, because achievement tends to be measured far less frequently than absence, which is a day-by-day phenomenon. The learning-loss costs of teacher absence, however, have high face validity.

Inequity, seldom out of the picture in U.S. education, rears its head in teacher absence. Students in schools serving predominantly low-income families tend to endure teacher absence at a higher rate than students in more affluent communities.²⁷ Thus, it's plausible that achievement gaps can be attributed, in part, to a teacher attendance gap.

The absence culture

The professional culture of a school—the norms, formal and informal, that guide teachers' behavior—has a facet related to absence. Researchers have studied this facet, the so-called absence culture, along two dimensions.²⁸ The first has to do with how similarly teachers behave to one another.²⁹ One study found, for example, collusive behavior among teachers in one school as an explanation for its consistently high absence rates relative to rates found in neighboring schools.³⁰ Researchers in Australia found that an increase in the average absence rate of a teacher's colleagues increased the teacher's own absence tally.³¹

The second dimension of absence culture focuses on trust among staff.³² Trust can be framed as the degree of professional autonomy enjoyed by teachers.³³ Absences in low-trust settings can represent a “deviant” or “calculative” mindset, depending how much tug the culture has on teachers’ behavior.³⁴ Such behavior in the realm of absence hardly sounds conducive to school improvement, and it underscores broader concern with trust in the research literature on school improvement³⁵ and in practical matters such as states’ applications for competitive federal grants under the Race to the Top program.³⁶

Illness and occupational hazards

The nature of teachers’ work may explain some of their absences. Multiple studies have linked teacher absence with job-related stress,³⁷ and there’s some evidence that absences due to symptoms and complications of vocal strain may be prevented with classroom amplification systems.³⁸ Anecdotal reports suggest that new teachers are particularly susceptible to student-borne illnesses, making the notion that teachers’ immune systems require a period of adjustment appealing.³⁹ Research following this line is difficult to do because new teachers tend to be absent less often than their more experienced colleagues, in part because they lack the privileges and job security, and perhaps in part because they’re better able to power through, engaging in “presenteeism.”⁴⁰ At any rate, school-wide use of hand sanitizer reduces rates of teacher absence.⁴¹

Timing

Researchers consistently find two patterns in the timing of teachers’ absences. First, teachers are absent most frequently on Mondays and Fridays.⁴² Second, a high proportion of absences due to illness occur in blocks of time short enough that no medical certification is required.⁴³ These findings are hardly surprising given that they are consistent with findings from studies of employees in other fields. Information about such patterns is lost in the blunt, school-level measure of absence embraced by the Civil Rights Data Collection survey, but that does not preclude these data from bringing light to a dark corner of education policy and practice.

The Civil Rights Data Collection dataset

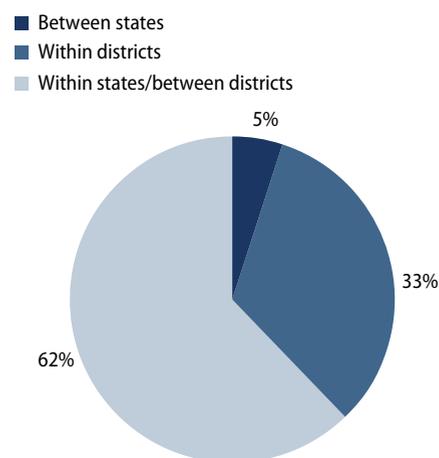
Every two years the Office for Civil Rights surveys a representative sample of schools and district comprising 85 percent of the students in the country.⁴⁴ Additional data on school characteristics and demographics from the Department of Education’s Common Core of Data complement the Civil Rights Data Collection survey. The present analyses focuses on a sub-sample of 56,837 schools reporting information for the 2009-10 school year. This analytic sample includes only regular or charter schools in regular or charter districts. It excludes schools other than primary, middle, and high schools or those with missing values on variables critical to the analysis. Schools with implausible values on the absence measure, including all schools in the District of Columbia, were also excluded from the analyses that follow. An appendix offers descriptive statistics of the analytic dataset. (see Table A1)

Newness of the measure

The percentage of a school’s teachers absent more than 10 times during the school year is a novel measure. This means that before testing hypotheses about how the measure relates to other variables like charter status, for example, it’s valuable to simply estimate where one is most likely to find information that explains variation: between states or within states and between districts or within districts. Figure 1 depicts this breakdown. (see Appendix for technical treatment)

Because districts, as actual employers, hold most of the policy and management cards, it’s no surprise that the majority of the variation in the Civil Rights Data Collection survey’s leading indicator is between districts but within states. In contrast, the fact that a third of the measure’s variation happens within districts may be surprising. This share of variation should be enticing to

FIGURE 1
Where does the variation in teacher absence happen?



Source: Author’s calculation based on the publicly available information pertaining to the 2009-10 school year in the U.S. Department of Education’s Civil Rights Data Collection, managed by the Office for Civil Rights, and Common Core of Data, managed by the Institute for Education Sciences within the National Center for Education Statistics.

researchers interested in issues such as professional culture and other difficult-to-measure but immensely important constructs—principal autonomy around hiring and budget—that have bearing on school improvement.

The 5 percent of variation that resides between states may seem negligible, but this is precisely the wrong conclusion to draw. This kind of variation would likely be easiest to explain. It’s probably not random, but rather attributable, for the most part, to the policy parameters embedded in state education code. This means that a state-by-state ranking of the average number of teachers absent more than 10 times should inform debate about adjusting these parameters. Table 1 includes these rankings, along with the median value on the absence measure (as many schools come in above the median as below), and the number of schools featured in the analytic dataset.

TABLE 1
Ranking teacher absence by state

Mean, median, and rank-order by mean of the percentage of teachers absent more than 10 days, by state, along with number of schools

State	Mean	Median	Number of schools	Mean Rank
AK	40.2	45.6	201	17
AL	40.5	42.2	1,113	16
AR	48.5	48.5	548	3
AZ	34.1	32.5	1,058	33
CA	32.9	29.4	5,907	38
CO	42.7	39.5	1,178	10
CT	38.3	34.0	713	21
DE	23.6	20.3	157	48
FL	29.1	28.6	2,865	47
GA	34.1	33.1	1,922	32
HI	49.6	60.9	207	2
IA	39.1	36.9	564	19
ID	41.4	42.9	395	14
IL	31.7	27.8	2,255	41
IN	44.7	46.2	1,170	9
KS	36.1	34.9	756	28
KY	37.4	34.3	827	24
LA	38.3	37.9	1,046	20

MA	36.3	33.9	1,060	26
MD	35.5	33.9	1,247	29
ME	33.6	32.5	410	36
MI	45.6	44.4	1,749	6
MN	42.3	38.7	864	11
MO	35.0	30.0	1,215	31
MS	32.6	29.0	689	39
MT	31.1	27.5	366	43
NC	37.4	36.8	2,033	23
ND	29.7	25.7	243	46
NE	33.3	30.9	576	37
NH	39.8	38.0	281	18
NJ	32.5	26.9	1,477	40
NM	47.5	50.0	504	5
NV	31.4	29.1	492	42
NY	42.3	39.5	1,778	12
OH	40.9	38.9	1,936	15
OK	30.6	27.3	937	44
OR	48.0	47.4	831	4
PA	36.2	33.3	1,940	27
RI	50.2	51.6	208	1
SC	33.8	32.8	955	34
SD	23.2	22.0	319	49
TN	30.5	31.2	1,360	45
TX	33.7	28.9	5,043	35
UT	20.9	17.8	553	50
VA	37.7	36.6	1,539	22
VT	35.4	29.9	138	30
WA	44.9	46.5	1,280	8
WI	37.0	33.3	1,139	25
WV	45.1	46.6	577	7
WY	41.5	40.0	216	13
Total	36.3	33.4	56,837	

Source: Author's calculation based on the publicly available information pertaining to the 2009-10 school year in the U.S. Department of Education's Civil Rights Data Collection, managed by the Office for Civil Rights, and Common Core of Data, managed by the Institute for Education Sciences within the National Center for Education Statistics.

A glimpse behind state averages

Georgia and Texas have similar means of 34.1 and 33.7, respectively, ranking 32nd and 35th among all states. Texas, however, has a lower median. A larger share of Texas's schools than Georgia's schools has high percentages of teachers absent more than 10 days. The difference appears as the variance in the thickness of the

FIGURE 2A
Density plot of school-level teacher absence measure for Texas

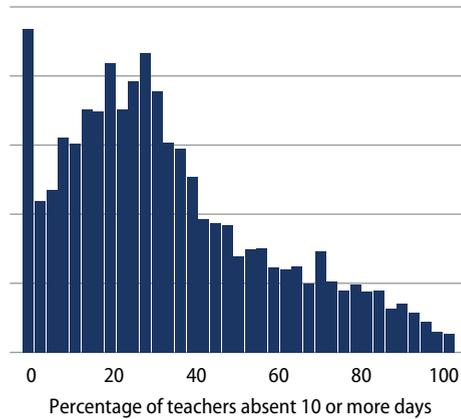


FIGURE 2B
Density plot of school-level teacher absence measure for Georgia

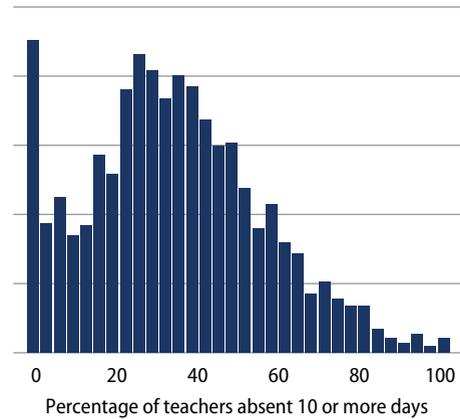


FIGURE 2C
Density plot of school-level teacher absence measure for Hawaii

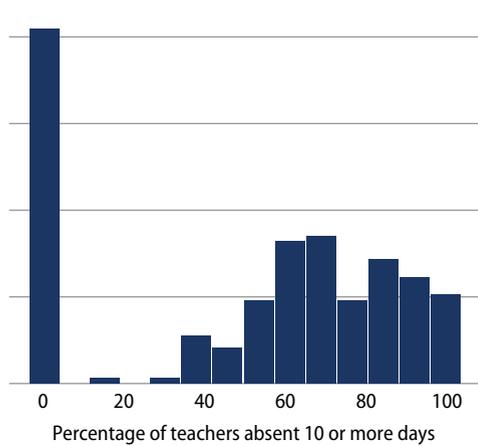
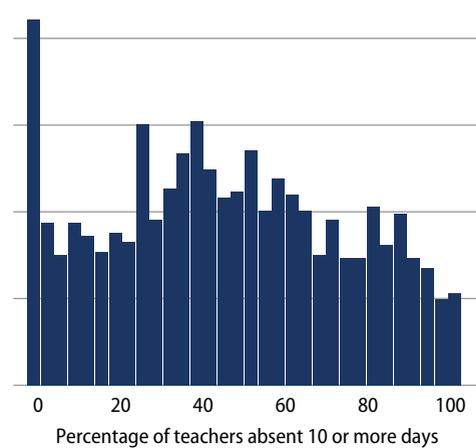


FIGURE 2D
Density plot of school-level teacher absence measure for Michigan



Source: Author's calculation based on the publicly available information pertaining to the 2009-10 school year in the U.S. Department of Education's Civil Rights Data Collection, managed by the Office for Civil Rights, and Common Core of Data, managed by the Institute for Education Sciences within the National Center for Education Statistics.

right-hand tails of the distributions depicted on page 10 (Figures 2a and 2b). Based on the otherwise similar distributions, it's reasonable to speculate that the combination of state and local policies concerned with teacher absence are fairly similar—and prudent—in these two states.

Hawaii and Michigan also have similar means of 49.6 and 45.6, which ranks them near the top of the heap, but it would rash to imagine that these states have similar policy regimes. Their distributions of schools' values on the absence measure couldn't be more different. (see Figures 2c and 2d) With a median substantially higher than its mean, Hawaii's distribution is somewhat bi-modal. One cluster of schools has very low rates; the rest have values concentrated at the high end of the range.

It would be reasonable to hypothesize that absence cultures in Hawaii's schools exert a strong influence on individual teachers' behavior. In some schools this means it's rare for any teacher to be absent more than 10 days; in others, the majority of teachers miss school frequently. Michigan's distribution of values, in contrast, is fairly uniform. Thus, there might be a fuller spectrum of absence cultures in Michigan.

This brief exposition of patterns of teacher absence within and between states just scratches the surface of what researchers could learn by patching detailed absence information into longitudinal data systems. Such research endeavors can take guidance from this report's remaining findings.

Results

The remainder of the empirical work here focuses on relationships between observed school characteristics and the measure of teacher absence. Straightforward statistical techniques yielded a number of estimated relationships simultaneously. (see Appendix) Exploratory work shows that schools in towns suffer rates of teacher absence 3 percent to 5 percent higher than schools in cities, suburbs, or rural areas. This difference did not register, however, once grade-level configuration, charter status, and select student demographic variables were thrown into the mix.

Grade level and type of school matters

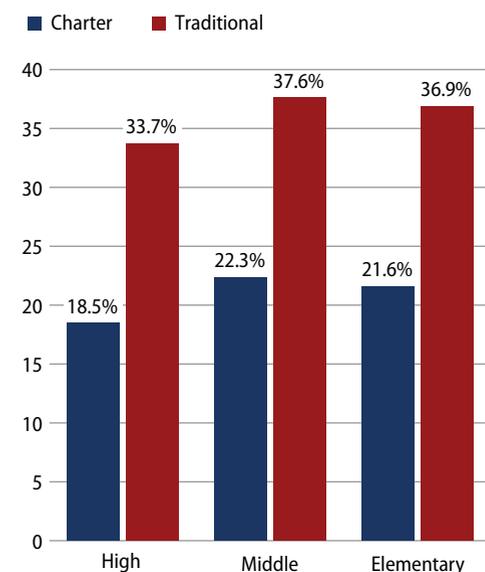
One might expect schools to differ on the measure of teacher absence based on grade-level configuration and charter status. Female teachers are under-represented in high schools, and charter schools offer different salary, wage, and leave benefits than traditional public schools. The analytic sample includes quite a few schools of each grade level and type combination. (see Appendix Table A2)

Figure 3 shows how the predicted percentage of teachers absent more than 10 days depends on grade-level configuration and charter status. Teachers are absent from traditional public schools more than 10 times per year at a rate more than 15 percent higher than in charter schools.

A school's grade-level configuration relates to the Civil Rights Data Collection's absence measure as one would expect based on prior studies with other measures of absence. An average of 33.3 percent of teachers were absent more than 10 days in high schools, while 36.7 percent and 37.8 percent of teachers were so absent in elementary and middle schools, respectively.

FIGURE 3

Predicted percentages of teachers absent more than 10 times for combinations of school-level and charter status, with other predictors (percentages of African American and Latino students) set to their average values



Source: Author's calculation based on the publicly available information pertaining to the 2009-10 school year in the U.S. Department of Education's Civil Rights Data Collection, managed by the Office for Civil Rights, and Common Core of Data, managed by the Institute for Education Sciences within the National Center for Education Statistics.

Racial disparity

The percentage of African American students in a school helps predict the percentage of teachers absent more than 10 days. Holding constant the grade level and whether a school is a charter, a school at the 90th percentile for African American students has a teacher absence rate 3.5 percentage points higher than a school at the 10th percentile. The corresponding differential based on the percentage of Latino students is 3.2 percentage points.

These race-based differentials are statistically significant, but it's not clear how educationally significant they are. Further investigation of potential disparate impact of teacher absence by race should be on advocates' research agendas. Combined with existing knowledge about the negative impact of teacher absences on student achievement, it's fair to say that this evidence reaffirms teacher absence as a leading indicator of surveillance and accountability concerned with closing achievement gaps.

Conclusion

This report goes a little way towards validating the “leading indicator” label of the Civil Rights Data Collection measure of teacher absence. The state-by-state averages and other statistically meaningful relationships detected here strengthen the empirical basis for revving up debate and negotiations around policies related to teacher absence.

Researchers should burrow into fine-grain absence data to answer questions about the effects of various policy changes. School districts are pregnant with potential to realize significant financial savings through the implementation of new combinations of policies and management tools. The discussions required to reduce teacher absence and claw back associated learning loss require sensitivity to the real human needs of teachers, the scarcity of resources, and the urgency of improving achievement overall and closing achievement gaps.

Acknowledgments

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Appendix

Data

The data used here come from publicly available information pertaining to the 2009-10 school year in the U.S. Department of Education’s Civil Rights Data Collection, managed by the Office for Civil Rights, and Common Core of Data, managed by the Institute for Education Sciences within the National Center for Education Statistics. The analytic sample includes a sub-sample of 56,837 schools reporting information for the 2009-10 school year. The schools are only regular or charter schools in regular or charter districts. They are primary, middle, and high schools. Schools with missing values on variables critical to the analysis, and those with implausible values on the absence measure, including all schools in the District of Columbia, were excluded from all analyses. Table A1 offers select statistics on continuous variables. Table A2 offers cross-tabulations of schools by charter status and grade-level configuration.

TABLE A1
Select statistics for information on 56,837 schools in the analytic dataset

Variable	Definition	Mean	Standard deviation	Minimum	Maximum
Absent	Percentage of teachers absent more than 10 times	36.3	24.6	0	100
Teachers	Number of teachers assigned to school	37.1	26.6	1	494
Asian	Percentage of students identified as Asian or Pacific Islander	3.3	6.9	0	100
Black	Percentage of students identified as African American	17.7	25.1	0	100
Latino	Percentage of students identified as Hispanic	20.7	26.4	0	100

Native	Percentage of students identified as Native North American	1.4	6.6	0	100
White	Percentage of students identified as white	56.3	33.3	0	100
Free	Percentage of students eligible for free or reduced-priced lunch	50.5	27.5	0	100

TABLE A2
Numbers of schools by grade-level configuration and charter status

Level	Traditional	Charter	Total
Primary	35,903	486	36,389
Middle	10,875	140	11,015
High	9,246	187	9,433
Total	56,024	813	56,837

The measure of teacher absence, being new to the Civil Rights Data Collection, not surprisingly suffers from a small quality control problem. The survey’s definition of teacher absence excluded days missed for approved professional development where the teacher would have otherwise been teaching. But two different definitions of teacher absenteeism may have included days spent on professional development as an absence. There’s no reason to believe this “noise” in the data biases the results presented here one way or another.⁴⁵

Method

This report uses straightforward regression methods to partition and then explain variance in the Civil Rights Data Collection measure of teacher absence. In the unconditional means model represented by this equation:

$$\text{Absent}_{ijk} = \alpha + \delta_k + \mu_j + \epsilon_{ijk}$$

Absent_{ijk} is the percentage of teachers absent 10 or more times in school i located within district j and state k . The α represents the unconditional grand mean of Absent_{ijk} in the population of schools. The remaining terms represent residuals, the stochastic components of a complex error term allowing for three sources of random variation: that within district, that between districts but within states, and that

between states. Fitting the model to data produces little other than estimates of the variance of these three random effects. Figure 1 illustrates the relative share of total variance occurring between states, within states but between districts, and within districts. These percentages are 5 percent, 62 percent, and 33 percent, respectively.

The so-called partition of variance afforded by the unconditional model provides new knowledge, as this report is the first to employ multiple regression methods in the study of $Absent_{ijk}$, an indicator constructed from a novel data element in the 2009-10 school year version of the Civil Rights Data Collection survey. Two points of knowledge stand out. First, the small share of variation occurring between states means that there is little danger in simplifying models of $Absent_{ijk}$ by dropping the random effect at the state level. Second, between district variation accounts for approximately two-thirds of the variation occurring within states, but variation within district accounts for the other third. At bottom, the partition of variance offered here should entice further study of the relationship between teacher absence and district policies, on the one hand, and the professional culture of schools, on the other.

This paper does a bit of both by way of the model represented by this equation:

$$Absent_{ijk} = \alpha + C + B + L + M + H + \mu_{jk} + \epsilon_{ijk}.$$

Here C is an indicator of whether a school is a charter school or a traditional school (default), and B and L represent the percentages of students in a school identified as African American or Latino, respectively. The M and H are indicators of whether a school is a middle school, high school or a primary school (default). Table A3 offers results of fitting several versions of this model to the data.

TABLE A3

Select parameter estimates, and goodness of fit statistics for a series of models fit to a dataset in which each observation is a school. Estimated p-values based on robust standard errors (not shown)

Variable	Column 1	Column 2	Column 3
Black	0.063***	0.066***	0.070***
Latino	0.050***	0.058***	0.059***
Charter	-15.239***	-15.230***	-15.214***
Middle	0.712**	0.750***	0.684**
High	-3.160***	-3.118***	-3.115***
Constant	34.792***	40.949***	34.478***
Schools	56,837	56,837	56,837
Districts	6,303	6,303	6,303
Within-district variance	202.6	202.6	202.6
Between-district variance	415.5	389.4	480.5
Proportion of total variance between districts	0.672	0.658	0.703
Within-district R-squared	0.028	0.028	0.028
Between-district R-squared	0.008	0.073	0.005
Overall R-squared	0.004	0.032	0.002
Fixed effects	none	state	district

* p<0.05; ** p<0.01; *** p<0.001

The race-based differentials and the effects of charter status and school level, discussed on page 13, were constructed by applying the parameter estimates from column 1 to prototypical values of the variables included in the model. Columns 2 and 3 show estimates for the model fit with the addition of state or district-fixed effects. Because the parameter estimates are stable across the three specifications, the ones pertaining to the most parsimonious model are preferred. The percentiles used in constructing these differences are as follows: the 10th percentile for the percentage of African American students is 0.5; 90th percentile, 55.4; the 10th percentile for the percentage of Hispanic students is 0.8; 90th percentile, 65.7.

The parameter estimates were robust in a set of sensitivity analysis in which extraordinarily small schools or large schools were omitted. Surprisingly, school size itself was not a useful predictor of teacher absence.

Endnotes

- 1 Claudia Vargas, "Camden School District hires private substitute-teacher agency," *The Philadelphia Inquirer*, August 16, 2012, available at http://articles.philly.com/2012-08-16/news/33233648_1_substitute-teachers-teacher-certification-haddon-township-school-district.
- 2 Nazmul Chaudhury and others, "Missing in Action: Teacher and Health Worker Absence in Developing Countries," *Journal of Economic Perspectives* 20 (1) (2006): 91–116.
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