School absence and student background factors: A multilevel analysis

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As part of regular collections, South Australian government schools provide data on students, including individual student absences during one full term (usually 10 weeks). These data were analysed to understand how student absence is affected by student background and school contexts. A multilevel statistical model of student absence was developed using data collected in 1997, and repeated for 1999. This paper presents the findings for students in primary schools, showing that absence rates for indigenous students, while higher than the rates for non-indigenous students, are affected by school factors such as the concentration of indigenous students in the school and school socioeconomic status.

student attendance, student absence, multilevel models, socioeconomic status, indigenous students

Introduction

Regular attendance is an important factor in school success. Students who are chronic non-attenders receive fewer hours of instruction; they often leave education early and are more likely to become long term unemployed, homeless, caught in the poverty trap, dependent on welfare, and involved in the justice system (House of Representatives 1996, p. 3). High rates of student absenteeism are believed to affect regular attenders as well, because teachers must accommodate non-attenders in the same class. It has been suggested that chronic absenteeism is not a cause of academic failure and departure from formal education, but rather one of many symptoms of alienation from school. Chronic absenteeism, truancy and academic failure may be evidence of a dysfunctional relationship between student and school, suggesting that schools need to be more student-centred and supportive of students with different needs. This argument is supported by research that highlights significant associations between student background factors, poor attendance, and early school leaving (Altenbaugh, et al. 1995; Bryk & Thum 1989; Fernandez & Velez 1989).

Previous research has concentrated on students who are "chronic" or "persistent" non-attenders, examining family, academic and social background factors related to the student. Other research has concentrated on schools with high absence rates, examining student composition, school "climate" and other organisational factors associated with these rates. What has been missing is a combination of these two approaches, because the computational technology has not been available.

A European perspective on student absences was provided in a study of absenteeism in 36 high schools in four Dutch cities. Bos, Ruijters and Visscher (1992) examined aspects of absences for individual classes over three school days, a Monday, Wednesday and Friday, covering a total of 8,990 lessons. They differentiated between truancy (disallowed absence, one "without a reason that is considered valid by the school") and allowed absences (one "regarded as valid by the school"). They found variation by school in the determination of a truancy, but calculated overall absence rates of 9.1 per cent, comprising a 4.4 per cent truancy rate and a 4.7 per cent allowed absence rate. Truancy rates were lower in pre-university tracks than vocational education tracks,

highest on Fridays, and tended to be higher later in the school day. Whole-day truancy occurred more frequently on Mondays. The proportion of "non-Dutch" students in the school accounted for 42 per cent of the variance in school truancy rate. The authors used schools' administrative data to get a snapshot of truancy, reporting valuable information about truancy and absenteeism in general.

DeJung and Duckworth (1986) reported on a study of absences in two cities in the western United States. Examining data from six high schools on class absences rather than whole-day absences, they calculated absence rates of 15 per cent for the larger of the two districts, and 10 per cent for the smaller. When using whole-day absences only, rates were 4.4 per cent for the larger district and 2.8 per cent for the smaller. The researchers also asked students why they were absent from individual class periods. Of the 1,200 students in the sample, 20 per cent of students stated that they had "other things to do," rather than attend school for a day; illness and personal problems accounted for less than 10 per cent of absences. Students with very high absence rates identified parties, drugs and a general dislike of school for most of their absences.

Throughout the 1970s, American high school principals consistently identified poor attendance as the major problem facing secondary school administrators. But rather than define poor attendance, studies concentrated on examining factors associated with it. Wright (1978) analysed secondary school-level data in Virginia, surveying schools on their attendance rates and aspects of the curriculum, organisation and staff. He found statistically significant differences by location: urban schools had the lowest attendance rates, then suburban schools; schools in other areas had the highest attendance rates. Within these geographical groupings, different factors were related to attendance rates, including subject offerings (electives), work programs for school credit, and age of the teaching staff.

Reid (1982), using data from an urban comprehensive school in a disadvantaged area of Wales, examined social background factors and self-concept in "persistent" absentees, whom he defined as students with absence rates of 65 per cent of every school term, and control groups of matched students, who were "good attenders, usually making 100 per cent attendance during an average term." He found differences in family structure, father's occupation, mother's employment and occupation, and eligibility for free school meals. Of the three groups in the study, persistent absentees also scored lowest on the Brookover scale of academic self-concept, and lowest on the Coopersmith scale of self-esteem, with no differences between male and female absentees.

Two high schools in Ontario, Canada, contributed data on 54 students to a study to determine the influence of personal, family and school factors on absenteeism. Corville-Smith, Ryan, Adams and Dalicandro (1998) used discriminant analysis to identify which factors could identify truants. Perceptions of school and parental discipline and control were found to be significant factors, as were students' perceptions of family conflict, academic self-concept and social competence in class. Unfortunately, their sample was severely restricted by selection bias: only 27 of a possible 295 volunteered to participate, and more than two-thirds were female.

Some researchers have attempted to examine the influence of attendance on academic achievement. In 1923, Odell (1923) reported small, non-significant correlations between attendance and either academic achievement or intellectual development, but significant correlations between attendance and grades awarded by teachers for class work. Finch and Nemzek (1935) reported that school grades were related to student attendance for the 1934 graduating class at one high school in Minneapolis, Minnesota. Kersting (1967) compared attendance records for the 100 highest achieving and 100 lowest achieving students in the junior high school where he was teaching. Comparing these extreme groups, he found significant differences in attendance. These studies

show that while there may be a relationship between attendance and achievement, it is very poor attenders whose achievement is low, but no threshold absence rate is defined.

Research on student attendance points to some groups of students whose attendance record, as a group, is relatively poor, such as the "non-Dutch" students reported by Bos, Ruijters and Visscher (1992). For most collections of student attendance data in Australia, however, such information has not been available. Most education departments limit their annual end-of-year collections to absences at the school level, with no differentiation by any student factors. In 1997, South Australia began an annual collection of data on student absences during one ten-week term. This paper provides an analysis of these data, supplementing a summary report provided to schools and education department officials (Rothman 1999).

Data

In South Australia, government schools have the capacity to monitor student attendance electronically using computers and software. This software, called EDSAS, allows schools to record the date, type and reason for each student non-attendance.[1] Four types of non-attendance can be recorded: whole-day, morning, afternoon, and late. Sixteen reasons can be recorded, nine of which count as absences. The others, such as sport excursions and work experience, are acceptable reasons for which the student is considered present. This information can then be matched with student information to provide a rich picture of attendance and non-attendance patterns. Available student information, as provided by the school as unit records during the midyear census, includes grade (year level), date of birth, sex, indigenous status, socioeconomic status, and special need.[2]

The data in this paper were collected from schools that use EDSAS to monitor student attendance. For this paper, only whole-day absences for full-time students were used. When absence rates are discussed, the sample was limited to those students who were enrolled at one school for the entire term. The number of students and schools included each year are contained in Table 1. Comparative enrolment data are from the midyear census, conducted each year on the first Friday on or after 1 August and reported in the National Schools Statistics Collection (Australian Bureau of Statistics 1998).

In 1997 and 1998, Term 2 began after the Anzac Day holiday and was ten weeks long. There were two Monday holidays—Adelaide Cup Day (Week 4) and Queen's Birthday (Week 7)—bringing the total number of school days to 48. Term 2 started one week earlier in 1999; with Monday holidays for Anzac Day (Week 2), Adelaide Cup Day (Week 5) and Queen's Birthday (Week 9), there were 52 school days.

The data contained in this paper are from the 1997 and 1999 collections of individual student absences. To ensure consistency for the analysis, the files were trimmed to include only primary level full-time students who attended a single school for the entire term, resulting in 67,732 students in 304 schools in 1997, and 84,820 students in 411 schools in 1999.

Because the data are based on administrative collections, there are limits to the student-level and school-level variables that are included. Student-level variables include sex (SEX, male=0, female=1), indigenous background (ABOR, indigenous=1), SES (CARD, low SES=1), and grade level (Reception to Year 7). School-level variables include location (LOCATION, metropolitan=0, country=1), size (SIZE), per cent indigenous students (PCTABOR), per cent low SES students (PCTCARD), and per cent female students (PCTFEM). Other school indicators (Commonwealth Literacy Program or Country Areas Program school) were eliminated because of their similarity to other school-level variables. Grade level was eliminated because there was little variation by grade level across schools. Frequencies and summary statistics for the files are listed in Table 1.

Table 1. Summary statistics of variables, 1997 and 1999

	1997 (48 days)			1999 (52 days)		
Student-level variables	*n*	*Per cent of sample*	*Absences per student*	*n*	*Per cent of sample*	*Absences per student*
Sample total	**67,732**	**100.0**	**2.9**	**84,820**	**100.0**	**3.3**
Grade level						
Reception	6,924	10.2	3.5	9,065	10.7	3.8
Year 1	8,260	12.2	3.1	10,485	12.4	3.4
Year 2	8,460	12.5	2.8	10,784	12.7	3.2
Year 3	8,853	13.1	2.7	10,672	12.6	3.0
Year 4	8,628	12.7	2.8	10,994	13.0	3.0
Year 5	8,814	13.0	2.7	10,990	13.0	3.0
Year 6	8,981	13.3	2.9	10,886	12.8	3.3
Year 7	8,812	13.0	3.2	10,944	12.9	3.5
Sex						
Male	34,981	51.6	2.9	43,821	51.7	3.2
Female	32,751	48.4	3.0	40,999	48.3	3.3
Indigenous background						
Non-indigenous	65,755	97.1	2.8	82,320	97.1	3.1
Indigenous	1,977	2.9	7.4	2,500	2.9	7.3
Socioeconomic background						
Middle/upper SES	41,470	61.2	2.6	54,421	64.2	2.9
Lower SES	26,262	38.8	3.4	30,399	35.8	4.0
Location [a]						
Country	25,800	38.1	3.3	28,970	34.2	3.5
Metropolitan	41,932	61.9	2.7	55,850	65.8	3.1
School-level variables	***Mean***	***Minimum***	***Maximum***	***Mean***	***Minimum***	***Maximum***
Absences per student [b]	3.0	0.6	11.1	3.3	0.2	11.7
Size (Students R-7)	222.8	12	757	206.4	11	812
Per cent female	47.9	29.6	66.7	48.0	30.0	70.8
Per cent indigenous	3.2	0.0	84.0	3.6	0.0	100.0
Per cent low SES	40.8	0.3	88.5	37.3	4.2	90.5
Number of country schools		161	53.0%		202	49.1%
Number of metropolitan schools		143	47.0%		209	50.9%

[a] Location was used as a school-level variable only.

[b] Absences per student is an unweighted measure. For the weighted average, see the rate for student-level variables.

Methodology

It was assumed that individual student absences were influenced by student characteristics, such as sex, indigenous background and low socioeconomic status, in the context of the school the student attended. The relationship among the variables can be denoted as

$$\text{TOTABS} = \beta_{0j} + \beta_{1j}(\text{SEX}) + \beta_{2j}(\text{ABOR}) + \beta_{3j}(\text{CARD}) + \varepsilon_{ij}$$

at the student level, and

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{LOCATION}) + \gamma_{02}(\text{PCTABOR}) + \gamma_{03}(\text{PCTCARD}) + \gamma_{04}(\text{SIZE}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{LOCATION}) + \gamma_{12}(\text{PCTABOR}) + \gamma_{13}(\text{PCTCARD}) + \gamma_{14}(\text{SIZE}) + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}(\text{LOCATION}) + \gamma_{22}(\text{PCTABOR}) + \gamma_{23}(\text{PCTCARD}) + \gamma_{24}(\text{SIZE}) + u_{2j}$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}(\text{LOCATION}) + \gamma_{32}(\text{PCTABOR}) + \gamma_{33}(\text{PCTCARD}) + \gamma_{34}(\text{SIZE}) + u_{3j}$$

at the school level. Preliminary analysis showed that because the percentage of students by sex is generally within a narrow range for primary schools, the variable PCTFEM could be excluded

from the model. Each of the student-level variables was grand-centred around the mean, so that the intercept term would represent the estimated mean number of days absent for schools, assuming that each school enrolled students with all the same student-level characteristics.

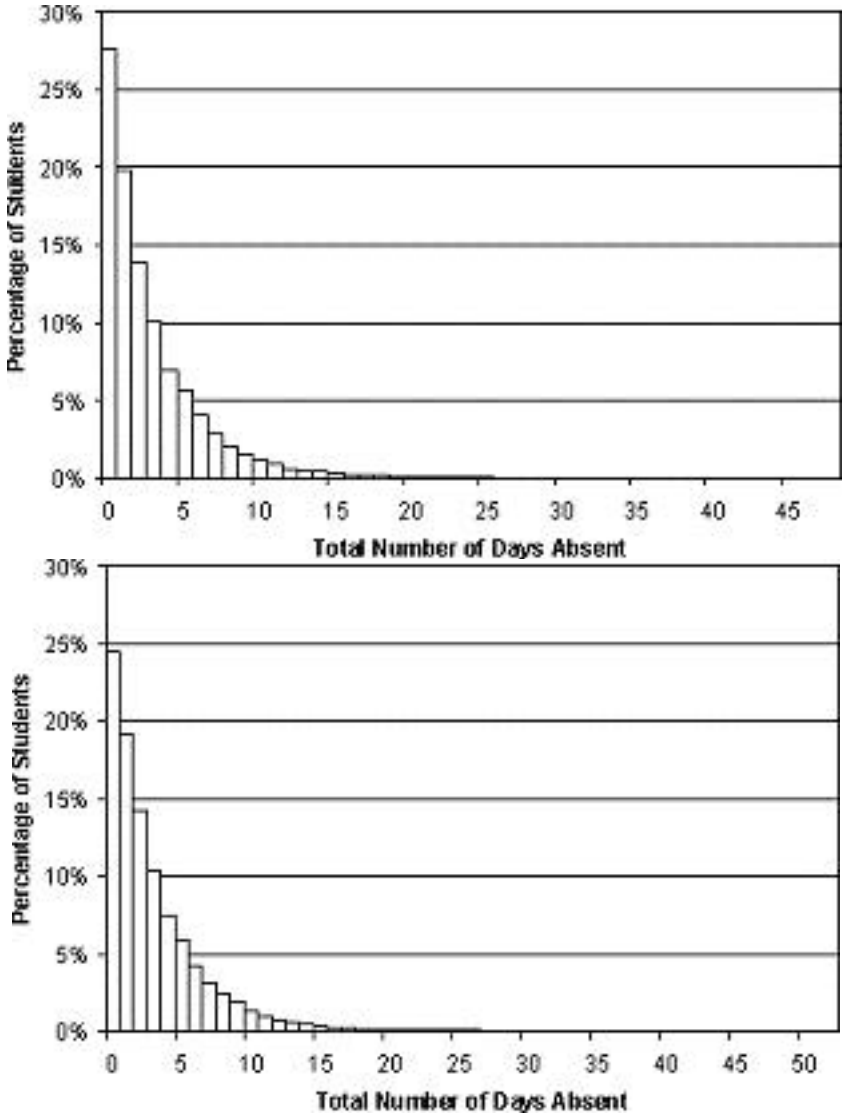

Figure 1. Distribution of number of days absent per student, 1997 (top) and 1999 (bottom)

Analysis of absences across all students in all schools showed that the data did not fit a normal distribution. In 1997, 27.7 per cent of students had no absences all term; in 1999, 24.4 per cent had no absences. The high number of zeros in the data (see Figure 1) meant that a standard transformation could not be used to approximate a normal distribution. HLM offers computational options for a dependent variable that represents counts. The Poisson option in HLM results in a nonlinear analysis using a hierarchical generalised linear model (Bryk, Raudenbush and Congdon 1996, ch. 5). The analysis proceeds adding variables in three stages, with adjustments at each stage to include only significant variables. The final model shows how each of the variables influences a school's absence rate. The analysis was first done using the 1997 data, with 1999 used as a replication. The following discussion considers the 1997 analysis; results for 1999 are contained in the tables. The steps in the analysis are similar to those followed by Rumberger (1995) in his analysis of middle-school dropouts.

Models

The first step in a multilevel analysis is to estimate a model with no student- or school-level variables, estimating the variances in the dependent variable at the student and school levels and testing whether there are significant differences between schools. Transforming the estimate of the intercept in the HLM analysis, the predicted mean of the number of absences per school is 3.02 for 1997. The estimated variance of the intercept term is small (0.091) but significant. The estimated number of absences per student would most likely fall between 2.23 and 4.08 [$\exp(1.104 \pm (.091)^{1/2})$], one standard deviation below and one standard deviation above the mean.

The next step in the analysis was the addition of student-level predictors to the model. As noted above, student characteristics were contained in three dummy variables: SEX, ABOR and CARD, representing gender, indigenous background and socioeconomic status, respectively. Sex was not significant and was removed from the model and all subsequent analyses. Indigenous background and socioeconomic status were both significant, but the estimated variance for SES was small, so that its effect on the overall model was minimal. For subsequent analyses, the slope for SES was fixed; the slope for indigenous background remained random. Once the model was re-evaluated with only significant student-level variables and the SES slope fixed, the estimated parameter variance for the intercept was smaller than the estimated parameter variance in the ANOVA with random effects (0.065 versus 0.091). Controlling for differences in the background characteristics of students accounted for 31 per cent of the variance in average number of absences per school (Table 2, Column 2).

Table 2. Summary of results for variance explained by HLM models, 1997 and 1999

	1997		*1999*	
	Parameter (1)	***Variance Explained (2)***	***Parameter (3)***	***Variance Explained (4)***
Mean number of absences per student (β_0)				
Intercept (δ_{00})	1.104		1.195	
Variance (τ_{00})	0.091**		0.090**	
Student-level variables only	0.063**	30.9%	0.062**	31.2%
+ Location	0.061**	32.7%		
+ Student composition	0.056**	37.8%	0.055**	38.9%
Indigenous background (β_2)				
Intercept (δ_{20})	0.471			
Variance (τ_{22})	0.381**			
+ Student composition	0.349**	8.5%		

** Significant at .01 level.

School-level variables were then added, first by including school location (metropolitan or country). Although children live in country or metropolitan areas, it was decided that location better described the school rather than its students. There are many examples of country students enrolled in metropolitan schools, especially because of the classification of schools. The Australian Bureau of Statistics (ABS) classifies statistical local areas (SLAs) as metropolitan if they fall within a boundary marked by Gulf St Vincent in the west, Gawler in the north, the Adelaide Hills to the east, and Aldinga to the south; Stirling, in the southeastern hills, is also considered metropolitan. All other parts of the state are considered non-metropolitan (country), including communities well within commuting distance to Adelaide. The addition of location was significant, although it reduced the estimated parameter variance of the intercept by only an

additional 1.8 per cent. It had no effect on the estimated parameter variance of the student-level variable ABOR.

Student composition of the school was the next set of variables to be added to the model. This set comprised three variables, PCTABOR, PCTCARD and SIZE, which were added simultaneously to the intercept and the student-level variable ABOR (CARD was fixed). Only PCTABOR and PCTCARD had significant effects on the intercept, but only PCTABOR was significant on the ABOR slope. The school size variable, SIZE, was not significant. The addition of these variables reduced the parameter variance of the intercept an additional 5.1 per cent, for a total of 37.8 per cent. When PCTABOR was added to the slope of ABOR, that parameter's variance was reduced by 8.5 per cent.

The final model for the 1997 data was

$$\text{TOTABS} = \beta_{0j} + \beta_{2j}(\text{ABOR}) + \beta_{3j}(\text{CARD}) + \varepsilon_{ij}$$

at the student level, and

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{LOCATION}) + \gamma_{02}(\text{PCTABOR}) + \gamma_{03}(\text{PCTCARD}) + u_{0j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{22}(\text{PCTABOR}) + u_{2j}$$

$$\beta_{3j} = \gamma_{30}$$

at the school level.

The procedures were replicated for the 1999 data, with both ABOR and CARD remaining as the only significant student-level variables with the CARD slope fixed. The first school-level variable, LOCATION, was not significant for 1999, and was rejected. Among the school composition variables, only PCTCARD had a significant effect on the intercept; no variables affected the ABOR slope. The addition of student-level and school-level variables to the 1999 model reduced the parameter variance of the intercept by 38.9 per cent, more than the 1997 model and with fewer explanatory variables. The final model for 1999 was

$$\text{TOTABS} = \beta_{0j} + \beta_{2j}(\text{ABOR}) + \beta_{3j}(\text{CARD}) + \varepsilon_{ij}$$

at the student level, and

$$\beta_{0j} = \gamma_{00} + \gamma_{03}(\text{PCTCARD}) + u_{0j}$$

$$\beta_{2j} = \gamma_{20} + u_{2j}$$

$$\beta_{3j} = \gamma_{30}$$

at the school level.

Results

The models presented above have shown that differences in school absence rates—as represented by the mean number of days absent per student—are affected by school location (in 1997) and student composition. Within schools, an individual student's absence rate is affected by indigenous background and low SES background. The final estimates of the effect of each of the student- and school-level variables are contained in Table 3. The estimates in the table represent the multiplier effects at student and school levels.

In the final 1997 model (Table 3, Column 2), school location made a difference, with metropolitan schools having a mean absence rate about 8.2 per cent lower than country schools, controlling for the per cent of students in the school who are indigenous or from low SES families. That is, for a school in Adelaide, the school absence rate would be 91.8 per cent of the rate of a country school with the same student composition. While this is statistically significant, across an entire school year it is equivalent to approximately one full school day. Considering that the data were collected in Term 2, which is the only term with Monday holidays, this difference may be explained by absences for "family/social" reasons—most likely for travelling over a long weekend In 1999, there was no difference by location (Table 3, Columns 3-4), when there were three long weekends.

The school mean absence rate was also influenced by the percentage of students of indigenous background and from low SES families. For each per cent of the total school population who were from indigenous background, the mean school absence rate increased by 0.5 per cent. For example, a school's absence rate increased by 10 per cent if it had an indigenous percentage of students 20 per cent higher than another school. A school with 50 per cent indigenous students would have an absence rate 10 per cent higher than a school with 30 per cent indigenous students.

Table 3. Estimates of adjusted school mean absence rates, indigenous background and socioeconomic status, primary students

	1997		*1999*	
School-level variables	***(1)***	***(2)***	***(3)***	***(4)***
Mean absence rates [a]				
Location (Metropolitan schools)	0.916**	0.918**		
Per cent indigenous		1.005*		1.004**
Per cent low SES		1.002*		
Indigenous background [b]				
Intercept		1.602**		1.622**
Per cent indigenous		1.019**		
Low socioeconomic status [c]				
Intercept		1.193**		1.246**

* Significant at .05 level.
** Significant at .01 level.

[a] Coefficients represent the estimated effects on the mean absence rate due to a one-unit change in the listed variable. Estimates control led for student-level variables of indigenous background and low socioeconomic status.
[b] The intercept term represents the estimated effect for indigenous background, while the other coefficient represents the change to the intercept for a one-unit change in the listed variable.
[c] The intercept term represents the estimated effect for low socioeconomic status, which was fixed across all schools.

Indigenous students, on average, had higher absence rates than non-indigenous students. The intercept for indigenous students was allowed to vary according to the percentage of indigenous students in the school, and this effect was significant. In a school with the mean percentage of indigenous students (3.2%), an indigenous student's absence rate was 60 per cent higher than the absence rate of a non-indigenous student. For a school with an above-average percentage of indigenous students, an indigenous student's rate increased by 1.9 per cent for each per cent above the mean indigenous population; for a school with a lower-than-average percentage of indigenous students, an indigenous student's absence rate was less than 60 per cent higher than a non-indigenous student's rate. In 1999, no school-level factors affected the student-level factor of indigenous background.

While this shows that indigenous students, on average, were absent more frequently than non-indigenous students, it also shows that a student's indigenous background has less impact on non-attendance than first thought. Summary data in Table 1 showed that the absence rate for indigenous students was 2.6 times the rate for non-indigenous students in 1997, and 2.4 times in

1999. The estimates from the HLM analysis show that when other factors are controlled—such as school location and the percentage of indigenous and low-SES students in the school—the effect on the absence rate decreases to 1.6 in both years. Indigenous students still miss on average more than 60 per cent more school than non-indigenous students—equivalent to about 7 school days across an entire year—but because this figure is much smaller than originally calculated using simple means, more reasonable targets can be set for absence reduction programs for indigenous students.

In both 1997 and 1999, a lower SES student had a 20 per cent higher absence rate than a middle/upper SES student. Thus, if a middle/upper SES student had missed 5 days during the term, a lower SES student in the same school would have missed 6. The simple means showed differences of about 33 per cent; but controlling for student- and school-level factors, this difference is reduced. Although there were indications of interaction between indigenous background and low socioeconomic status, no significant effect was found to be significant.

Discussion

Absenteeism is believed to have a major impact on student learning, but just how absenteeism affects academic achievement has not yet been explained. The simple examination of indigenous students' absence rates presents a serious challenge to educators in Australia, even if there are other factors that influence what appears to be higher rates. While indigenous students' absence rates are not as high as first thought, they are still higher, on average, holding other factors constant, than non-indigenous students' absence rates by about 60 per cent. Similar findings exist for students from lower SES backgrounds: lower SES students' absence rates are higher than middle/upper SES students', but the difference is not as great after controlling for school-level factors.

The finding reported above about the percentage of indigenous students in a school and its effect on an indigenous student's absence rate gives credence to theories stating that educational disadvantage is exacerbated by concentrations of similarly disadvantaged students, although this applies in this analysis to indigenous students only. Is it an issue of relevance for indigenous students? Schools that enrol higher proportions of indigenous students are located in more remote areas of South Australia, and these schools do have higher absence rates than other schools.

While differences in absence rates vary according to student background, this explains only 38 to 39 per cent of the variance; much of the variance in school absence rates remains to be explained. Some of this variance may be explained by student factors not used in the present study, such as those that examine attitudes toward school, parents' education levels and previous achievement, among others. School factors that were not included, such as school organisation, leadership and age of the teaching staff, may also help to explain some of the variance (see Bryk and Thum 1989; Bos, Ruitjers and Visscher 1992; Corville-Smith, Ryan, Adams and Dalicandro 1998).

This study has highlighted the importance of choosing an appropriate design for analysis of school data, especially when the data are gathered as part of an educational system's administrative collection. Such data are often used to establish simplistic benchmarks for the system, and for each individual site within the system, as part of an accountability program. While such an approach may be the ideal because we believe that student background should not have a negative influence on student achievement, the reality is that there are still achievement differences associated with background characteristics. If benchmarks for attendance are to be set, they must account for some of the differences between student composition of the school, otherwise schools may be undeservedly penalised.

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[1] A *non-attendance* occurs when a student is not present at the school. For some non-attendances, such as school sport, camps and excursions, and work experience, students are considered present, although at a different site. A student is considered *absent* for the following reasons: illness, family/social activities, exemption, suspension and exclusion without an alternative program. An unexplained non-attendance is also considered an absence.

[2] Socioeconomic status is measured according to whether the student is recipient of a "school card," based on family income. A school card entitles a student to subsidies for school fees and other school-related expenses. This variable is dichotomous: a student either receives or does not receive a school card. Students with special needs enter into a negotiated curriculum plan; a student either has a plan or does not have a plan.