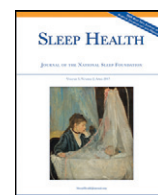




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Earlier school start times are associated with higher rates of behavioral problems in elementary schools



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ABSTRACT

Background: Early school start times may curtail children's sleep and inadvertently promote sleep restriction. The current study examines the potential implications for early school start times for behavioral problems in public elementary schools (student ages 5–12 years) in Kentucky.

Method: School start times were obtained from school Web sites or by calling school offices; behavioral and disciplinary problems, along with demographic information about schools, were obtained from the Kentucky Department of Education. Estimated associations controlled for teacher/student ratio, racial composition, school rank, enrollment, and Appalachian location.

Results: Associations between early school start time and greater behavioral problems (harassment, in-school removals, suspensions, and expulsions) were observed, although some of these associations were found only for schools serving the non-Appalachian region.

Conclusions: Findings support the growing body of research showing that early school start times may contribute to student problems, and extend this research through a large-scale examination of elementary schools, behavioral outcomes, and potential moderators of risk.

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Early school start times may contribute to *sleep restriction* in adolescents,^{1,2} defined as receiving less than the adequate amount of sleep (ie, between 9 and 11 hours per night) that is recommended for children between the ages of 6 and 13 years by the National Sleep Foundation (www.sleepfoundation.org). Earlier school start times require earlier wake times.² This has recently been found for elementary school students (ages 5 through 11 years),³ although overall reductions in sleep duration were not observed. Studies with adolescents consistently find that earlier start times are related to shorter sleep duration.¹ For example, early-adolescent students attending an early-starting middle school (at 7:15 AM) reported significantly more daytime sleepiness and 37 less minutes of total sleep than students attending a late-starting school (8:37 AM).⁴ Conversely, postponing school start time by 30 minutes in a private high school resulted in an average of 45 additional minutes of sleep and a lower percentage of adolescent students suffering from sleep restriction and daytime sleepiness.⁵ Thus, a substantial body of research documents associations between early school start times and student sleep restriction.

However, very few studies have examined the impact of school start times on the sleep and functioning of elementary school students, typically aged 5 through 11 years.⁶ The National Sleep Foundation recommends that children between the ages of 6 and 13 sleep between 9 and 11 hours per night (www.sleepfoundation.org). Unfortunately, children aged 6–10 are only getting an average of 8.9 hours of sleep per night, whereas children aged 11–12 have an average of only 8.2 hours,⁷ indicating that many American children have restricted sleep. Examination of elementary schools is an especially important direction for research because when school districts attempt to shift start times, they sometimes choose to have elementary schools start earlier so that adolescent students at middle and high schools can start later and bus schedules can be maintained.^{8,9} Elementary students then must wake earlier.³ In a recent study, however, elementary schools with earlier start times had lower average standardized test scores and were ranked lower on academic performance than other schools.⁶ The implication is that the sleep restriction associated with early school start times would be shifted to younger children.

This sleep restriction may have important consequences for children's daytime functioning.¹⁰ For example, short sleep duration is associated with increased risk for father-reported rule-breaking behavior and externalizing symptoms in an epidemiological study

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of 8-year-old children.¹¹ Restricted sleep is also associated with greater externalizing symptoms in children aged 7 through 12 years.¹² Consequently, early school start times may indirectly lead to increases in child behavior problems. Although one study did find that delayed high school start times improve mood and reduce depressive symptoms in adolescents,⁵ no study to our knowledge has examined school start times in relation to behavioral adjustment of students. The current study examines rates of disciplinary actions (in-school removals, suspensions, and expulsions) as well as rates of behavioral incidents in relation to school start times. We hypothesize that earlier start times will be associated with greater behavioral problems.

The current study also advances research through examination of moderators of associations. School districts may be unable to delay all school start times, and therefore information about what schools may be most likely to benefit is important. Student socioeconomic status may serve as a moderator, as early school start times were related to poor academic performance only for those schools serving middle- or upper-class elementary students.⁶ Based on these findings, we take the perspective of a cumulative risk model,¹³ in which the accumulation of multiple risks that occurs in poverty prevents the amelioration of any one single risk factor from dramatically improving child outcomes such as behavior problems. Poverty is associated with lower parental warmth, less consistent discipline, greater harsh parenting practices, family violence and instability, poor housing, less cognitive stimulation and resources for education, poor quality childcare and schools, and dangerous and deteriorating neighborhoods.^{14,15} It is likely that students who are struggling with poverty face such a wide range of obstacles to their achievement and to their sleep quality that school start times simply have little impact.^{16,17}

We therefore hypothesize that the association between start times and school behavioral issues will be less strong for schools serving a greater number of impoverished students. We index student poverty in 2 ways: the percentage of students receiving free or reduced cost lunches and whether the county is designated as Appalachian. The Appalachian region occupies a majority of eastern Kentucky. It has a higher percentage of people who fail to complete high school diplomas and with lower family annual income compared with the non-Appalachian regions of Kentucky.^{18,19} Therefore, schools in Appalachian counties are more likely to serve high rates of impoverished students.

Method

Data were collected for all eligible public elementary schools in Kentucky. In Kentucky, an elementary school refers to a school having any combination of kindergarten (ages 5–6 years) through the sixth grade (ages 11–12 years). Schools were considered ineligible if they were vocational schools, alternative schools, schools that only included pre-kindergarten through the second grade, private schools, special education schools, and schools in juvenile justice centers. These exclusion criteria were designed to minimize variability in behavior problems due to school characteristics and the population being served. Two elementary schools were removed from analyses because their start time was 1:40 PM. We were unable to determine the start time for one elementary school. The resulting sample included 718 elementary schools serving a total of 310,470 children.

School start time data were collected via school Web sites or by calling the school office. Other variables were obtained via the Kentucky Department of Education Web site (<http://education.ky.gov>). Data are from the 2011/2012 school year. Means and standard

deviations are provided in Table 1. Independent variables included in the study are as follows:

- 1 School start times: Start times were computed as minutes since midnight.
- 2 School rank: percentile rank of a school based on overall school academic performance, ranging from 0 to 100. Higher percentile rank indicates better school performance. Schools are ranked against other schools of their level (ie, other elementary schools).
- 3 Appalachian county (APPALACHIAN): whether the school is located in a county that has been designated as Appalachian according to the Appalachian Regional Commission Web site (<http://www.arc.gov/about/index.asp>). There are 54 counties out of 120 in Kentucky that are designated as Appalachian.
- 4 Free and reduced cost lunches (FREELUNCH): percentage of students in the school receiving free or reduced cost lunches.
- 5 Teacher/student ratio (TSRATIO): the average number of students per teacher.
- 6 Percentage African American (AFRICAN AMERICAN): percentage of students who are African American in a given school. The average percentage across all elementary schools was 9.10% (SD = 14.52%) and ranged from 0% to 76.0%.
- 7 Percentage Hispanic (HISPANIC): percentage of students who are Hispanic in a given school. The average percentage across all elementary schools was 4.71% (SD = 6.70%) and ranged from 0% to 73%.
- 8 Enrollment: the number of children enrolled as students in each school.

Student behavioral problems were measured in several different ways. In most cases, measures of behavioral problems used in this study reflect the need for disciplinary action (eg, number of suspensions) rather than the specific forms of behavioral problems (eg, bringing a gun to school) because the disciplinary actions are the focus of school reports to the government. For each measure, 2 scores were available: the number of unique incidents reported for the year and the number of students involved for the year. Examining these 2 scores permits assessment of the frequency of behavioral problems and the number of students who are involved in these problems. Because the same student may be involved in multiple incidents across a school year, they provide different information. Information about each dependent variable is provided below. Common definitions of behavioral events are provided in the document *Common Definitions for Board Policy Violations in a School Situation* available at <http://education.ky.gov/school/sdfs/Documents/Board%20Policy%20Definitions%20final%202,013.pdf>. Kentucky guidelines for disciplinary actions are provided in the statute KRS 158.150 (available at <http://www.lrc.ky.gov/statutes/statute.aspx?id=3451>).

- 1 Total discipline: Discipline involving any of the following: in-school removal, out-of-school suspension, expulsion with or without services, corporal punishment, restraint, or seclusion. Few school districts in Kentucky use corporal punishment (eg, paddling), but it continues to be legal in the state and is more commonly used in rural or Appalachian districts. Restraint techniques may include physically escorting the student, carrying the student, cradling the student, or other forms of physical restraint. *Seclusion* refers to confinement of the student in a room or area but does not include time outs used to calm students.
- 2 In-school removals: Disciplinary action in which the student is removed from his/her regular educational setting during instructional time. Examples include alternative placement and in-school suspensions.
- 3 Out-of-school suspensions: Disciplinary action in which the student is placed on a temporary mandatory leave from school for a predetermined period of time, usually ranging from 1 day

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