



UNIVERSITY OF WISCONSIN

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*Translating Research into Policy and Practice*

# Brief Report

## Annotated Bibliography on “Green and Healthy” Schools

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*Schools represent a complicated network of inter-related systems, including building characteristics, the surrounding physical environment, as well as administrative and educational activities directed toward student achievement and well-being. Environmental sustainability has become a popular paradigm for managing these systems and improving student health and performance. This brief bibliography summarizes research on the “Green and Healthy Schools” movement including key environmental interventions, evaluation strategies, and effects on health and health disparities.*

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## INTRODUCTION

The “Green Schools” movement has become increasingly popular and many of its proponents argue that improved student health is among the most significant benefits of school-based environmental improvement. This selection of research demonstrates the complexities of implementing “Green and Healthy Schools” and assessing the health effect of this type of school. Furthermore, the works in this bibliography also suggest that “green” school policies may occasionally conflict with policies directed exclusively toward student health. Additional research is needed to identify the areas in which policies that promote environmental sustainability may conflict with policies targeted to students’ health.

## ANNOTATED BIBLIOGRAPHY

### Book

**Committee to Review and Assess the Health and Productivity Benefits of Green Schools. *Green Schools: Attributes for Health and Learning*. Washington, DC: National Academies Press; 2006.**

This title from the National Academies Press represents the first comprehensive literature review on the effect of four categories of building characteristics—building envelope and moisture; indoor air quality; lighting; and acoustics—on school occupants’ health and student learning. Unfortunately the cause and effect relationship between design elements and health and learning is confounded by a large number of unobserved variables. Within each category, the level of evidence linking a building characteristic to health and educational outcomes varied considerably. The building envelope and moisture management within a school had clear ramifications for student health, especially regarding students with asthma and respiratory conditions. Further, poor maintenance of the building envelope or inadequately preventing excess moisture and mold result in significantly higher maintenance and repair costs.

Similarly, indoor air quality was easily linked to student health and performance. Ventilation rates, especially in building areas that house fumes, dander, or pests, are critical to reducing respiratory health

complications among students. Unfortunately, ASHRAE standards are below the ventilation rates that provide optimum air circulation. Additionally, green schools tend to emphasize natural/manual ventilation, such as operable windows, that can introduce pollution (car exhaust), allergens, and additional moisture into a school.

Acoustics of a school also contribute to student learning, though the impact on student health is unclear. Most evidence suggests schools be set away from heavily trafficked and noisy areas of the city to reduce ambient noise within the school. These settings can have an additional benefit of reducing the students’ exposure to outdoor and indoor air pollution, but may increase students’ travel time and risk of injury on their way to school.

Evidence connecting lighting and student health and learning is particularly limited. Studies suggest that the standard levels of light should be adequate to children with properly corrected vision. However, estimates of children who need corrected vision may be quite high. Green schools focus primarily on energy-efficient lighting, with limited suggestions for adequate lighting depending on the task. Green schools also promote natural lighting, which can provide good light levels, proper color perception, and improve students’ psychosocial health. However, natural lighting is significantly variable and can result in glare that makes studying difficult.

An issue that the authors only marginally discuss is the problem of conflict between “green school” recommendations and “healthy school” recommendations. The book proceeds on the premise that whatever fulfills one goal is likely to fulfill the other, but—as their examples indicate—this is not necessarily the case.

That said, the authors identify that a key problem in green schools is that current green school guidelines do not recognize that a school is a collection of inter-related systems, and focusing exclusively on one element can reduce overall school (building) performance. Consequently, they recommend that

future green schools emphasize overall building performance rather than a single objective such as energy efficiency. Their conclusion suggests, though does not make explicit, that health concerns may come in conflict with environmental concerns and, in those instances, outweigh them.

#### Journal Articles

**Davis JM and Cooke SM. Educating for a healthy, sustainable world: An argument for integrating health promoting schools and sustainable schools. *Health Promotion International* 2007; 22(4): 346-53.**

The authors outline the separate but parallel trends of Health Promoting Schools and Sustainable Schools, especially in the UK and Australia. Considering the holistic approach to health articulated by the World Health Organization, the authors conclude that these two approaches to improving and restructuring the school environment are necessarily consonant, and would result in synergies if implemented at the same time. Common features between the two programs include a holistic approach, participatory/action-based learning models, strong links between school and community, a systems approach to capacity building, and an emphasis on teaching skills that are easily translated into real-life contexts. By using a holistic HPS/ SS approach, the authors posit, school administrations will reduce the stress on teachers trying to keep abreast of educational “innovations” they are expected to implement.

In their review of SS and HPS, the authors address the need for further evaluation and the difficulty of establishing proper evaluation techniques. Because SS and HPS are both multi-dimensional approaches they require process- and outcome-based evaluations. Unfortunately, the authors lack examples of successful evaluations of these programs, and do not identify areas in which evaluations are needed.

**Everett Jones S, Axelrad R, and Wattigney WA. Healthy and safe school environment, part II, physical school environment: Results from the school health policy and programs study 2006. *Journal of School Health* 2007; 77(8): 544-56.**

The School Health Policies and Programs (SHPP) is conducted every six years by the CDC to investigate the degree to which schools and districts maintain recommended practices and standards to protect student health. This paper presents the results of the 2006 SHPP related to environment health policies in schools, included those related to indoor air quality, school bus emissions, hazardous materials, pest management, and lead exposure. Their results show that protective policies—integrated pest management, no idling zones, water testing for lead, and indoor air quality management planning—are more commonly established at the school level rather than the district level. HVAC systems, building foundation/walls/roofs, and presence of pests were the issues that were of most concern to districts and schools. Upwards of 90% of all schools surveyed had completed inspections of the above building components in the past year. Few schools (35.1%) tested the quality of water in on-site drinking water tanks or tested water outlets for lead (55.7%).

The SHPP also investigated the implementation of green school policies, and found that 60% of states required phase 1 environmental site assessments prior to the construction of a new school. Of all districts surveyed, 13% had energy efficiency policies; other green school policies (recycling, preservation of green space, water conservation, renewable energy, etc.) were even less common.

**Geller RJ, Rubin IL, et al. Safe and healthy school environments. *Pediatric Clinics of North America* 2007; 54: 351-73.**

This article is designed to provide an overview of health issues at schools for pediatricians, particularly for physicians asked to assist in health planning for schools. The authors address key environmental concerns at schools, such as emergency preparedness, the school’s physical environment (site selection, chemical exposures, crowding, lighting, noise, temperature/moisture), safety and hazard avoidance in sports/play, nutrition, and transportation. Like H. Frumkin’s book *Sprawl and Public Health* (2004), this article serves as a brief overview for areas of concern in the school environment; little analysis is provided.

**Murray NG, Low BJ, et al. Coordinated school health programs and academic achievement: A systematic review of the literature. *Journal of School Health* 2007; 77(9): 589-600.**

A common contention among proponents of health-promoting and green schools is that these interventions will improve student achievement. This article examines the literature related to student achievement and the following elements of Coordinated School Health Programs (CSHP): nutrition services, health services, mental health programs, staff health promotion programs, and school environment interventions. The authors find few rigorous assessments of nutrition, health, and mental health services. Those that do exist support the positive impact of these programs on student academic achievement. The literature these authors reviewed provided no evidence on positive or negative effects of health promotion and physical environment interventions. The authors conclude that there is only a very limited list of evidence-based practices under the CSHP model that schools can implement.

**Pastor M, Sadd JL and Morello-Frosch R. Reading, writing, toxics: Children's health, academic performance, and environmental justice in Los Angeles. *Environment and Planning C: Government and Planning* 2004; 22: 271-290.**

The authors address health disparities among low-income and minority children by examining the environment health risks to which these children are exposed at school. They find that the levels of outdoor air toxics around schools in the Los Angeles Unified School District are higher near schools with a high proportion of low-income or minority students. They then sought to determine if these exposures (as measured by the toxic release inventory [TRI] measures provided by the EPA) affected student performance. They created an ecological study that predicted average standardized test scores using % receiving free lunch, % of teachers with emergency credentials, % ESL students, mobility, student population, average educational achievement of parents, and air toxics measures. The demographic variables were intended to control for confounders that

would impact student test scores. Air toxics proved to be a significant predictor of lower standardized test scores, with a magnitude similar to that of teacher credentials, number of children in the school, and greater than the effect of mobility on student performance. While this suggests other factors, such as income, are more significant to student performance, the authors conclude that toxic exposures at school constitute a significant environmental justice concern and limit human capital development among disadvantaged students.

This article, while interesting, assumes that the pathway by which environmental toxics affect academic performance is through their effect on health. However, they do not measure the impact of air toxics on student health, only on academic performance. Furthermore, the study is an ecological design, since student-level data was not available. As other evidence suggests that the school environment does not affect student performance (or health) significantly, their conclusions may not be well supported.

**Pearlman D, Dowling E, et al. From concept to practice: Using the School Health Index to create healthy school environments in Rhode Island elementary schools. *Preventing Chronic Disease* 2005; 2: 1-16.**

The authors examined the use of the School Health Index (SHI) to assess school environments and implement changes to improve students' health. The SHI is comprised of 8 modules that describe a healthy school environment. According to the SHI, a healthy school environment is one that integrates policies, practices, and programming that promotes healthy behaviors and reduces risky behavior. Schools participating in the study performed a needs assessment using the Rhode Island Needs Assessment Tool (RINAT), and then used the SHI to design interventions in the areas of nutrition, physical activity programs, and school amenities to improve student health. The authors found that the SHI was almost universally viewed as a user-friendly tool, but that schools' success hinged upon staff turnover, time availability, and limited resources. Furthermore, schools that achieved successful implementation of healthy environment policies typically benefited from

an external facilitator that helped guide program implementation.

**St. Leger L and Nutbeam D. A model for mapping linkages between health and education agencies to improve school health. *Journal of School Health* 2000; 70(2): 45-50.**

These authors review the transition from classroom-based health promotion to a more integrated approach in which health promotion is woven into other interventions: building a supportive physical environment; creating a supportive social environment; implementing school policies that promote discipline, equity, and safety; providing health services; and collaborating with parents and communities. This expansion of health promotion into different school-based interventions is recommended because teachers alone lack the training and classroom promotion of health behaviors is limited in its effect.

**Srinivasan S, O’Fallon LR, and Dearry A. Creating healthy communities, healthy homes, healthy people: Initiating a research agenda on the built environment and public health. *American Journal of Public Health* 2003; 93(9): 1446-50.**

Research has turned more and more to examining the physical and mental health effects of the built environment, including housing, transportation, and schools and other public places. The authors summarize the literature by arguing that the built environment affects health behaviors, perceptions of health, and health quality through exposures to environmental toxins. Furthermore, the burden of poor health due to the built environment is disproportionately placed on low-income, minority residents. Despite these propositions, the state of research on the causal mechanisms between the built environment and health are limited, and the authors make general recommendations for expanding this body of literature based on the National Institute of Environmental Health Sciences conference “Built Environment—Healthy Communities, Healthy Homes, Healthy People” (July 2002).

**Thompson DR, Iachan R, et al. School connectedness in the health behavior in school-aged children study: The role of student, school, and school neighborhood characteristics. *Journal of School Health* 2006; 76(7): 379-386.**

School connectedness has often been considered a predictor of academic success and better health behaviors among students. This article using a hierarchical approach to determine student, school, and neighborhood characteristics that contributed to student connectedness. The authors find that female students, younger students, students from 2-parent families, and students that consider themselves “attractive” exhibit a stronger sense of school connectedness. At the school level, higher levels of racial/ethnic diversity resulted in lower school connectedness, whereas higher average parent income resulted in more connectedness. Schools placed in neighborhoods with a high proportion of renters exhibited lower rates of connectedness among pupils. Interestingly, schools in neighborhoods with a high proportion of non-U.S. citizens exhibited greater connectedness than those with lower rates of non-citizens.

**Warwick I, Aggleton P, et al. Evaluating healthy schools: Perceptions of impact among school-based respondents. *Health Education Research* 2005; 20(6): 697-708.**

Though this article does not address green schools in particular, it addresses the perceived benefits of a healthy school program by those intended to benefit by it—students, staff, and parents. This qualitative study revealed that, primarily, students generally appreciated the efforts made to improve the quality of their schools. In particular, students felt valued when administrators asked for their input and suggestions when implementing different programs. In some instances, however, students felt that the programs or policies were mainly cosmetic, and made little to no difference in the quality of the school or their experiences. Staff and parents similarly appreciated the opportunity to become involved in school improvement, and parents in some cases noted that changes in schools—such as improved nutrition during lunches or increased extra-curricular offerings—had the added benefit of improving their child’s health behaviors at home.