

# Green Health

---

# BUILDING SUSTAINABLE SCHOOLS FOR HEALTHY KIDS



A Workshop Co-sponsored by the National Collaborative for Childhood Obesity Research and the National Academy of Environmental Design

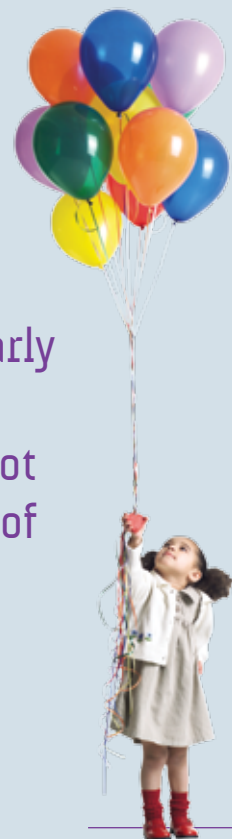
In partnership with the U.S. Green Building Council Center for Green Schools



An aerial photograph of a city, likely Chicago, showing a dense urban landscape with a grid of streets, buildings, and a large highway interchange. The sky is clear blue with a few clouds. A solid green vertical bar is on the left side of the image.

Instead, **ENVIRONMENTAL FACTORS**  
that influence when, where, and how much people eat and drink  
and how physically active they are  
must be engaged at a **POPULATION SCALE**  
to promote healthy behaviors.

A growing body of evidence clearly demonstrates that alterations in individual behaviors alone are not sufficient to change the course of the childhood obesity epidemic.



## CONTENTS

Introduction.....	5
SESSION 1: School Context and Neighborhood Connection.....	8
SESSION 2: Green and Healthy School Buildings.....	14
SESSION 3: School Playgrounds and Gardens.....	20
SESSION 4: Translating Innovation and Research Into Practice.....	26
SESSION 5: Innovative Tools for Green Health Design Research.....	32
SESSION 6: Increasing Capacity for Green Health Research and Practice.....	38
Appendices.....	43

# Introduction

## ROLE OF ENVIRONMENTAL DESIGN WITHIN CHILDHOOD OBESITY PREVENTION

Research indicates that environmental design at multiple spatial scales, from regional land use patterns to aspects of interior or graphic design, can influence social norms and default behaviors related to dietary choices and daily physical activity. Development and dissemination of multidisciplinary environmental design research focused on childhood obesity prevention offers the potential for a valuable suite of new health promotion tools. However, successful at-scale implementation of health-oriented built environment design strategies will depend on collaboration between public health and the design and building industries.

One clear opportunity for building such a partnership lies in the many synergies between the environmental design objectives of childhood obesity prevention and those of the sustainability/green building movement. Focusing on shared goals, such as community design that reduces automobile reliance and promotes active transportation, offers the prospect of a coordinated “Green Health” approach to built environment-oriented research. This is an attractive prospect given the growth and influence of non-profit advocacy groups such as the U.S. Green Building Council and the green building industry as a whole.

## WHY FOCUS ON THE DESIGN OF SCHOOL ENVIRONMENTS?

Schools represent an ideal focus for primary development of Green Health environmental design research focused on addressing both childhood obesity and sustainability. School facilities are pivotal community resources and a central part of each family and child’s daily life. They are mandated and positioned to help form social norms and default behaviors such as those related to health behaviors. However, comprehensive research specifically addressing the physical design of school environments is limited.

On October 27-28, 2011, the National Collaborative for Childhood Obesity Research and the National Academy of Environmental Design, in partnership with the U.S. Green Building Council Center for Green Schools, hosted Green

Health: Building Sustainable Schools for Healthy Kids. This workshop ([www.nccor.org/greenhealthworkshop](http://www.nccor.org/greenhealthworkshop)) used an interdisciplinary case-study approach to examine how environmental design strategies at multiple scales can be better used to promote physical activity and healthy eating in school environments. The workshop also explored how childhood obesity prevention can be integrated into school-based sustainability and green building initiatives and frameworks.

### WORKSHOP PARTICIPANTS AND OBJECTIVES

Participants included designers, urban planners, public health experts, and representatives from multiple federal agencies. Through presentations and discussions, participants:

- Examined how environmental design strategies at multiple spatial scales—neighborhood, school building, and schoolyard—can be used to promote physical activity and healthy eating.
- Discussed emerging tools for health behavior assessment and environmental measurement within school-focused obesity prevention research and examined training and capacity needs.
- Identified specific opportunities for integrating childhood obesity prevention, environmental sustainability, and green building research and practice.

### STRUCTURE AND METHODS

The 2-day invited workshop was organized into two main sections:

- An examination and showcasing of school design strategies at varying spatial scales, from land use to interior design, that can be manipulated to promote adoption of healthy eating and physical activity among children (Sessions 1 through 4).
- An examination of new tools for green health design research as well as advances in inter-disciplinary training opportunities to increase green health research and practice (Sessions 5 through 7).

The workshop concluded with a session in which participants discussed next steps to advance the field.





# School Context and Neighborhood Connection

## 1

### 48%

of children walked or biked to school in 1969.

### 13%

of children walk or bike to school today.



Promoting walking and biking to school as a core component of active community lifestyles is a major focus of both obesity prevention and sustainability research and advocacy.

School location and quality of multi-modal transportation infrastructure are well recognized as important determinants of rates of active transportation to school within communities. However, design-oriented research and tools that can promote green and healthy school design at a regional and neighborhood scale and that are specifically tailored to address the needs of decision-makers, city planners, and urban designers remain underdeveloped.

**SESSION 1** of the workshop highlighted three examples of recent innovations in regional- and neighborhood-scale environmental design:

- Release of the School Siting Guidelines developed by the U.S. Environmental Protection Agency (Matthew Dalbey, PhD; *U.S. Environmental Protection Agency*).
- Analysis of trends and determinants in active transportation (Noreen McDonald, PhD; *University of North Carolina, Chapel Hill*).
- Application of health-oriented design tools, such as the Active Design Guidelines, at an urban design scale by private design firms (Jack Robbins, *Perkins + Will Architects*).

#### SCHOOL SITING AND NEIGHBORHOOD DESIGN: HISTORICAL CONTEXT AND DEVELOPMENT OF EPA GUIDELINES

Designing and building schools and associated facilities is one of the largest investments a community can make. The myriad decisions involved reflect a community's educational priorities, as well as its fiscal, social, economic, environmental, and health goals. In the early 20th century, influential planners such as Clarence Perry advocated that neighborhoods should be the basis for city growth. He defined neighborhood size based on a 5-minute walking radius from a center that would be designated for community uses, such as schools.

In those early decades, neighborhoods and schools were interconnected. Schools at the centers of communities posed few transportation challenges because

children could walk or bike to school. Even as late as 1969, 48% of children walked or biked to school.

However, this model of the “neighborhood school” began to change as families moved out of the city and into new suburban communities. Decisions about what kind of schools to build and where to build them shifted to reflect emerging desires for desegregated educational facilities as well as efficiencies of scale within educational facilities. The result is our current landscape—abandoned central city neighborhood schools, new large schools built on lots on the periphery of communities, and reliance on cars and buses for transport. Schools have lost their physical siting at the hub of the community, which limits their historical function as a public space for recreation and learning for the whole community.

#### IMPETUS FOR THE DEVELOPMENT OF THE EPA SITING GUIDELINES

In recent years, concerns about environment, health, traffic congestion, pollution, and loss of community social cohesion, have led urban planners, designers, educators, health officials, and communities to rethink the physical and functional relationship of schools within their surrounding communities. Moving back to a neighborhood-based model is garnering increasing attention, but executing this model will require consideration of many complex and interrelated issues.

The U.S. Environmental Protection Agency (EPA) has developed voluntary school siting guidelines to help local school districts and communities evaluate environmental and public health factors in their decision-making about whether to renovate an existing school or build



Dalbey • Slide 5

### School Buildings and Community Building

#### KEY POINTS

- Schools have historically been used as a central hub of traditional neighborhood planning from both a physical and functional perspective.
- Prioritization of desegregation within schools and economies of scale within educational facilities over the past few decades have resulted in a relative decoupling of schools from their surrounding neighborhoods. Students must travel longer distances to school, making active transportation programs difficult to implement and limiting the use of school playgrounds and playing fields by the community.
- The recently released school siting guidelines developed by the EPA provide a voluntary guidance tool for school decision-makers to consider as they balance myriad factors, including health promotion opportunities, involved in choosing the location of facilities.

a new school on a new or existing site. In developing the guidelines, EPA articulated four fundamental principles that should guide the decision-making process:

- Safe and healthy school environments are integral components of the education process.
- The environmental review process should be rigorous, thorough, and well-documented and should include substantive and ongoing public involvement.
- Schools should be located in environments that contribute to the livability, sustainability, and public health of neighborhoods and communities.
- The school siting process should consider the environmental health and safety of the entire community, including disadvantaged and underserved populations.

The Agency released the final guidelines in Fall 2011 after a 2-year period of development, public comment, and revision. The guidelines describe a process that local school districts and their communities can use in working together to assess the environmental and public health risks and benefits of potential school locations. The guidelines also make recommendations about the

types of environmental and public health issues that can be assessed in school siting decisions. Promoting physical activity through a focus on active transportation to school is a prominent theme.

### RETHINKING THE RELATIONSHIP OF SCHOOL LOCATION AND MODE OF TRAVEL

A school's location has a major impact on how children travel to it. Therefore, a central precept of efforts to create a renewed neighborhood-based paradigm for schools is creating an environment that encourages children to walk or bike to school. Understanding recent trends in traveling to school and the reasons behind these trends can inform these efforts. The past 40 years have seen a dramatic shift in trends, with vehicles now far surpassing walking and biking as the primary mode of travel to school.

Several factors account for decreasing rates of walking and biking to school in the United States:

- **DISTANCE.** Not surprisingly, walking and biking decline steadily as distance from home to school increases. However, few K-8 students today live close to school. Only 30% of studies live a mile or less from school.
- **HOUSEHOLD DEMOGRAPHICS.**

The increase in women working outside the home has contributed to fewer children walking or biking to school or coming home for lunch.

#### • SOCIAL ATTITUDES AND EDUCATIONAL DECISIONS.

Concerns about safety have limited children's independent mobility, preventing many from walking or biking to school. Parental attitudes about the quality of neighborhood schools influence decisions about where to enroll their children, and the distance of the school ultimately chosen affects how children travel to school.

In response to these trends, communities have explored various options to encourage walking and biking to school, such as Safe Routes to School programs and walking school buses. The National Center for Safe Routes to School has developed guidelines that communities can use to create such programs. Randomized clinical trial data show that walking school buses are successful but difficult to sustain over the long term.

Other efforts, such as EPA's School Siting Guidelines, state guidelines and regulations, and the Development Approval Process, can help ensure that healthy ways of traveling to school are incorporated into decisions about where to locate

a school. However, ensuring open and continuous communications between state and local levels and various stakeholders (such as developers and school districts) is a continuing challenge.

### USING URBAN AND COMMUNITY DESIGN TO IMPROVE WALKABILITY

There is growing interest in implementing urban design strategies that help promote walking, biking, and use of public transportation in order to provide daily physical activity and help reduce the risks of chronic disease, early death, and generally improve well-being. However, translating, or operationalizing, "walkability" for the purposes of urban design practice and decision-making will require further innovation and research.

Numerous efforts are underway to establish "applied" walkability metrics. For example, beginning in 2000, the U.S. Transportation Research Board's Highway Capacity Manual, included a six-grade framework applying the traditional vehicle traffic flow construct of "level of service (LOS)" to pedestrian flow. LOS is a critical and core metric of transportation planning. It is widely used to set priorities for investments by evaluating the match between need (as measured by travel

### School Travel

#### KEY POINTS

- Decreases in rates of active transportation to school (walking and biking) over the past few decades reflect a confluence of factors, including community design and individual parental decisions.
- If they are to be effective, development of programmatic and design-based interventions to increase rates of active transportation to school will need to accommodate pressures toward larger and more peripherally located schools, social trends such as increases in rates of women working outside the home, and concerns about safety.
- Research to evaluate programs such as Safe Routes to School as well as tools specifically focused on design-relevant issues (e.g. EPA's School Siting Guidelines) is needed.



## Active Design Joins the Fight Against Obesity

### KEY POINTS

- Urban designers and planners can play an important role in encouraging daily physical activity by creating neighborhoods, streetscapes, and transportation systems that make walking, biking, and public transit easier and more enjoyable to use.
- Fulfilling the potential of collaboration between urban design and public health will require tools and metrics focused on operationalizing walkability for application within real-world design projects and decision making.
- Applied measures of pedestrian infrastructure quality and design tools, such as LEED for Neighborhood Development and the Active Design Guidelines, are emerging.
- Research is needed to develop, evaluate, and disseminate these important new design tools focused on translating walkability research into widespread use.

demand and quality of flow) and infrastructure quality.

The need to develop a LOS to address pedestrian and bicycle use is well-recognized but challenging to implement. For example, under a traditional LOS framework, LOS A is the ideal walking situation based on flow efficiency (i.e., it is the least crowded) and F is the worst (i.e., the most crowded). However, in practice, the paradigm of quality linked to flow rate does not necessarily translate to optimal parameters for walkability. For example, an empty highway may be optimal for a driver, but few pedestrians would find a completely deserted street the most appealing place to walk.

Several cities, including New York and Kansas City, have adapted an alternate concept of LOS that attempts to assess the walking experience of pedestrians in a more comprehensive and holistic manner. Similarly, researchers have developed frameworks that integrate

objective measures, such as physical characteristics (number of buildings, presence of outdoor dining), with subjective measures, such as perceptual qualities (human scale and tidiness), and individual reactions (sense of safety and comfort) to assess walkability LOS. In this framework, which reflects the overall quality of walking in a particular environment, perceptual qualities are the most important factors in determining the walkability of an environment (a much more familiar and useful perspective for designers).

Other efforts to operationalize walkability for urban designers and other built environment decision-makers are emerging. The U.S. Green Building Council has recently implemented a new product for their Leadership in Energy and Environmental Design (LEED) system that is focused on neighborhood-scale projects (LEED for Neighborhood Development). This rating system integrates the principles of smart growth, urbanism, and green building into the first national system for neighborhood design. LEED for Neighborhood Development includes many health-oriented criteria, including an emphasis on features shown to encourage walking and biking opportunities.

Other assessment tools, such as Walk Score, are becoming available for general use by groups such

## EXPANDING THE PARADIGM WHEN CONSIDERING THE WALKABILITY OF NEIGHBORHOODS



### PRESENTER

Tridib Banerjee, Professor, University of Southern California School of Policy, Planning, and Development, Los Angeles • [www.usc.edu/schools/sppd](http://www.usc.edu/schools/sppd)

Child pedestrian injuries are a continuing concern amid efforts to increase children's ability to walk and bike to school. These concerns have led to programs such as Safe Routes to School and walking school buses. A recent study examined safety issues around walking to school from the perspective of 5th grade children living in neighborhoods surrounding four Los Angeles elementary schools near the University of Southern California.

Participating children used maps of their neighborhoods with their routes to school marked to identify places they liked and felt comfortable walking in and places they did not like and were uncomfortable walking in. Investigators went to these locations and photographed them. They also

held focus groups with the children to explore the reasons why the children had these attitudes. A content analysis of the maps, photographs, and focus groups revealed that safety and social dangers outweighed traffic dangers for the children.

These findings demonstrate that including the social and institutional context of the environment is key to the extent to which residents will interact with their surrounding built environment in ways that can promote their health.

as realtors, house buyers, and others interested in assessing the walkability of a building or neighborhood. This innovative website scores locations based on how easy it is to walk to desired local destinations such as schools, parks, restaurants, shops, and businesses.

Another major innovation is the development of building-scale design guidelines such as the Active Design Guidelines developed through a collaboration between the City of New York and the New York City chapter of the American Institute of Architects (see sidebar). More than 100 years ago, New York City officials made changes to the design of the city to relieve overcrowding and

improve infrastructural elements, such as garbage disposal, sewers, and water quality. These changes radically improved the public health by reducing the incidence of infectious diseases such as diarrhea, tuberculosis, and pneumonia—the major causes of illness and death during that time.

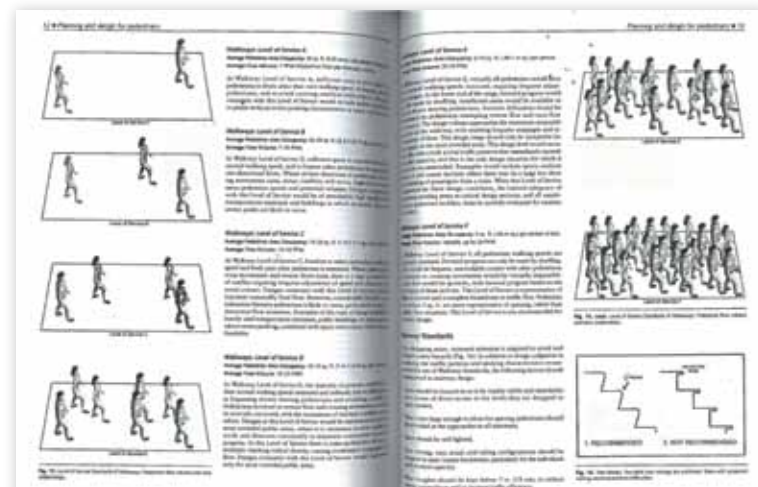
By improving the walkability of urban environments, designers and planners are once again attempting to reduce today's major causes of illness and death—chronic diseases such as obesity, diabetes, and heart disease—which are caused by poor diet and lack of physical activity.



### PRESENTERS

- Matthew Dalbey, Senior Policy Analyst, Development, Community and Environment Division, U.S. Environmental Protection Agency, Washington DC • [www.epa.gov](http://www.epa.gov)
- Noreen McDonald, Assistant Professor, Departments of City and Regional Planning and Urban Studies, University of North Carolina, Chapel Hill NC • <http://planning.unc.edu>
- Jack Robbins, Architect and Urban Designer, Perkins+Will Architects, New York NY • [www.perkinswill.com](http://www.perkinswill.com)

Robbins • Slide 82





# Green and Healthy School Buildings

## 2

### CHOICE ARCHITECTURE

This term refers to the science of using environmental design, including building architecture and interior design, to “nudge” the choices we make and to help establish healthy default behaviors.



Manassas Park Elementary School, VMDO Architects

The significant influence of school and classroom micro-environmental design on learning and social behaviors is well established and an area of ongoing education research.

In recent years, the green building industry has become increasingly interested in encouraging “green schools.” The impetus is to create school buildings that consume less energy and water, leave a smaller environmental footprint, and also take advantage of opportunities to foster social norms of environmental stewardship among children.

Recent advances such as Active Design Guidelines, which focus on building-scale features that can

help promote daily physical activity among occupants, highlight a parallel and potentially synergistic opportunity to optimize school architecture and interior design to help shape health-oriented attitudes and behaviors.

**SESSION 2** of the workshop highlighted three examples of recent innovations in building-scale environmental design focused on promoting physical activity and healthy eating:

- Application of behavioral economics research (often popularized as “nudging”) to optimize food choice behavior through small-scale changes in school cafeteria design (Adam Brumberg, *Cornell University Food and Brand Lab*).

- Review of evidence related to the impact of classroom and other school interior design on learning performance and health outcomes (Caren Martin, *University of Minnesota*).
- Case study of Buckingham Elementary School, designed by VMDO architects in collaboration with a health research team (University of Nebraska Medical Center, University of Virginia); the project focuses on providing a theory-based healthy food environment and includes a robust prospective evaluation plan (Steve Davis and Dina Sorensen, *VMDO Architects*; Terry Huang, *University of Nebraska Medical Center*).

#### BEHAVIORAL ECONOMICS IN SCHOOL LUNCHROOMS: EXPLORING THE POTENTIAL OF “CHOICE ARCHITECTURE” TO INFLUENCE HEALTHY EATING CHOICES

One approach to influencing social norms and behaviors through changes in the design of the school micro-environments is exemplified by the work of the Cornell Center for Behavioral Economics in Child Nutrition Programs. Using research on human behavior and the tools of psychology, the Center conducts behavioral economics research focused on “choice architecture,” or changing the design of school lunchrooms to help “nudge” children to make healthy food choices.

Choice architecture relies on the developmental fact that the rational



## Behavior Economics & School Cafeteria Design

### KEY POINTS

- Behavioral economics research has particular relevance and potential for guiding health-oriented school design, particularly with regard to school spaces such as cafeterias.
- Children's food choice behaviors are less rational than adults, making spatial and visual presentation of healthy items frequently more important than characteristics such as price or nutritional value.
- Continued development of environmental design research focused on how behavioral economics techniques can help nudge children toward healthy food choices is needed.

side of decision-making is not fully developed in children. They make food choices based on factors such as taste, convenience, and visual effect rather than on price, healthfulness, or logic. Fortunately, most children can find some healthy foods to be appealing and acceptable. The trick is to make slight alterations in the school lunchroom environment so that healthy foods are prominently available and unhealthy foods are less available and less convenient. A second key principle is to allow children to feel they are making the choice, not that they are being told what to choose.

Behavioral economics research has many clear applications for helping architects address healthy food environments as part of the school design process. Many choice architecture changes related to the environmental design of school cafeterias and graphic displays are simple and inexpensive, yet proven to be effective:

- Put healthy items within reach or in areas of high traffic.
- Create speedy “healthy express” checkout lines for children who are not buying desserts or chips. (These express lines are a desirable alternative given the limited time children have for lunch.)
- Retain the use of trays. (Children who don't use trays tend to leave

the salad behind because their entre and drink fill up both hands.)

- Provide choices between healthy items (carrots AND celery, not carrots only).
- Move the salad bar so that it is next to the cash registers.

### DESIGNING SCHOOL INTERIORS FOR LEARNING AND HEALTH

Interior design focuses on planning and designing interior spaces to meet people's physical and aesthetic needs, and takes into account health and safety concerns, among other considerations. It is a collaborative activity that works with landscape architecture, architecture, urban planning, land surveying, engineering, and graphic design. It also is an integral component of the human ecosystem model, which considers all the external factors that influence human behavior and health.

Interior design can play a role in childhood obesity prevention in a number of important ways:

- Physical elements, such as circulation hallways, well ventilated and naturally lit classrooms and gyms, and plentiful open gathering spaces, can provide increased opportunities for physical activity.



### CASE STUDY

#### SCHOOL BUILDING AS A CATALYST FOR CHANGE: BUCKINGHAM ELEMENTARY SCHOOL (BUCKINGHAM, VA)

Buckingham County, Virginia, is located in the center of the state, approximately 63 miles from Richmond and 45 miles from Charlottesville. The Buckingham County School Board has joined forces with VMDO Architects and health researchers from the University of Virginia and the University of Nebraska Medical Center to renovate and expand two adjacent elementary schools to provide an optimal school environment for healthy, “food-smart” children. The project will be completed in Spring 2012.

The design for the school renovation was developed using novel theory-based guidelines created collaboratively by the design and health research teams. The design focuses on:

- Promoting fresh and healthy food choices.
- Engaging the school community in food production.
- Nudging the school community toward healthy eating behaviors.
- Promoting awareness of healthy and sustainable food through signage and links to the curriculum.

- Articulating school spaces as community assets (such as by creating a community garden or holding a farmer's market on school grounds).

The project involves renovating and connecting the two schools, built in 1954 and 1962. The new configuration will consist of one school, Dillwyn Elementary School, with two buildings (K-2 and 3-5) that have separate identities but shared resources. The center of the new school community is an inviting gateway to the landscape beyond. In addition, the buildings include a variety of elements that encourage physical activity and healthy food choices, incorporate nutrition and physical activity into the curriculum and all aspects of the children's lives at school, and invite the surrounding community to share in this learning. Elements of the new school include:

- A public plaza in front of the school that provides space for community and 4H activities (connecting parents and the community with the school).
- A community room inside the school that can be used for a variety of activities, from lectures to

CONTINUED →

**CASE STUDY**
**SCHOOL BUILDING AS A CATALYST FOR CHANGE:  
BUCKINGHAM ELEMENTARY SCHOOL (BUCKINGHAM, VA)**

- yoga sessions (providing space for a wide range of learning experiences and shared activities with the community).
- A Food Lab Lounge next to the cafeteria that can be used for small group learning sessions around food (allowing children to discuss and learn about what they are seeing and experiencing directly).
  - A teaching kitchen next to the cafeteria kitchen (creating opportunities for hands-on learning about the full life cycle of food, from planting, tending, and harvesting to preparing and serving).
  - A kitchen with a bakery and open serving area so that children can see staff working inside, and a food tray drop that incorporates a composting element (elevating kitchen staff to teacher status and increasing communication and awareness between children and staff).
  - An eating area with large windows looking out to the garden, calm colors, acoustic ceiling baffles that reduce sound and reinforce the orientation of the room to the outside, and ergonomic furniture (creating a fun and relaxing space that sparks imagination and facilitates learning).
  - An outside two-level terrace near herb and vegetable gardens (providing opportunities to integrate the school curriculum with the children's eating and food experiences).
- A rigorous quasi-experimental mixed methods evaluation (quantitative and qualitative) has been built into the project. Investigators are examining the impact of the school redesign on the adoption

of school policies, programs, and practices that promote healthy eating; school personnel's attitudes and practices toward healthy eating; and students' behaviors, knowledge, attitudes, self-efficacy, and intentions toward healthy eating. Investigators are using a mixture of quantitative and qualitative methods, including audits, surveys, focus groups and other qualitative methods, and cafeteria purchase data to collect data about the effects of the redesign. Data from Dillwyn will be compared with demographically similar elementary schools in the same district.

This prospective assessment of architectural features thought to promote healthy eating is innovative because the study elements were incorporated at the outset of the redesign process. It also is one of the first studies to integrate an examination of environmental sustainability and obesity prevention. Its results will have significant policy implications in terms of establishing possible future criteria for LEED certification and providing evidence that adding healthy design does not necessarily increase costs. Given the large number of schools being renovated or built across the country, results from this study also have great potential to inform new standards for school design.

This project recognizes the need for leadership and political will as well as community buy-in. In addition, study personnel have learned to recognize and work within the realities of construction schedules, and this has been a challenge at times. To maximize the impact of the study and the project, study staff are carefully considering ways to disseminate results to the school and community and to the wider community of design and public health practitioners.



- Specific features, such as school gyms with cushioned floors, properly positioned computer monitors, and standing desks, can significantly improve physical activity rates as well as reduce sedentary time.
- Sensory attributes and aesthetic qualities highlighted through interior design can enhance the enthusiasm, curiosity, and spirit of adventure of children and school staff and act to promote more active and engaged use of the building spaces.

Designing interior spaces for schools to promote health and encourage physical activity face a number of challenges, both human and

environmental. Such spaces must meet the needs of all children, no matter their physical, cognitive, behavioral, and social abilities, and they must employ universal design principles. Interactive spaces that promote physical activity require more space and may be more costly than is desirable or available, and it may be difficult to meet the green design principles challenge of a zero carbon footprint by 2030.

Meeting these challenges involves partnering and including all stakeholders, respecting human and environmental needs, and meeting the triple bottom line of people, planet, and profit.

**Designing Healthy School Food Environments**
**KEY POINTS**

- Designing healthy school environments requires consideration of spaces at multiple scales, including school interiors.
- Interior design features can have a dramatic impact on behavior patterns within a building, from the traffic flow and circulation of people using the building to the overall engagement of inhabitants with building spaces.
- Research focused on health-oriented interior design is needed to characterize best practices and to promote physical activity and healthy eating for all building users, including children and adults with disabilities.

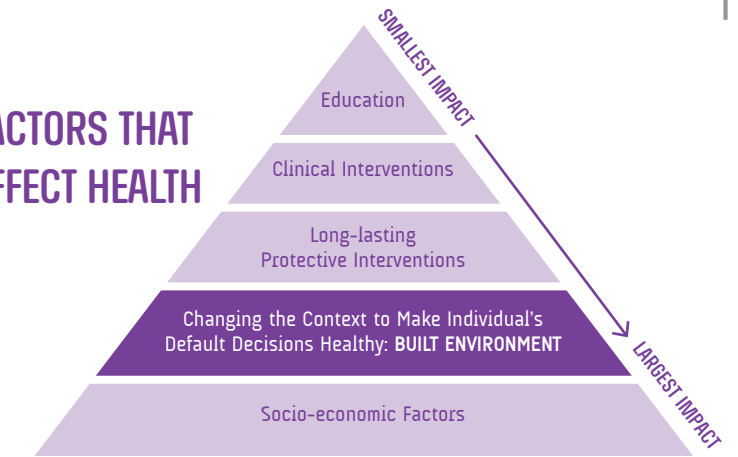

**PRESENTERS**

- Adam Brumberg, Deputy Director, Cornell University Food and Brand Lab, Ithaca NY • <http://foodpsychology.cornell.edu>
- Caren Martin, Associate Professor, Department of Design, Housing, and Apparel, College of Design, University of Minnesota, Minneapolis and St. Paul MN • <http://dha.design.umn.edu/programs/grad>
- Steve Davis, Director of Sustainable Design, VMDO Architects, Charlottesville VA • [www.vmdo.com/portfolio.asp](http://www.vmdo.com/portfolio.asp)
- Dina Sorensen, Designer, VMDO Architects, Charlottesville VA • [www.vmdo.com/portfolio.asp](http://www.vmdo.com/portfolio.asp)
- Terry Huang, Professor and Chair, Department of Health Promotion, Social and Behavioral Health, College of Public Health, University of Nebraska Medical Center, Omaha NE • [www.unmc.edu/publichealth/healthpromotion.htm](http://www.unmc.edu/publichealth/healthpromotion.htm)

# School Playgrounds and Gardens

## 3

### FACTORS THAT AFFECT HEALTH



SOURCE: Frieden, AJP, 100:590, 2010



School playgrounds and gardens represent a prominent opportunity for promoting sustainability and obesity prevention through environmental design.

Children need quality play structures and learning landscapes to provide contact with nature and make it easier for them to meet their requirements for at least an hour of active play each day. High-quality and engaging outdoor school facilities also create a forum for practicing social skills, developing sensory abilities, and generally gaining an appreciation for the natural world.

Schoolyards also can be an important community resource. They provide green space and enjoyable natural

habitats for neighborhood residents. Research supporting effective design, location, and operation of schoolyards that position them as community parks, gardens, and gathering places can make school facilities essential components of the common life of the community. Well-designed schoolyards can provide significant support for both sustainability and health promotion goals.

**SESSION 3** of the workshop highlighted developments in three areas that have important implications for school playground and garden design:

- Newly released developmental stage-based playground design guidelines (Mary Filardo, 21st Century School Fund).
- Recent research focused on the role of school landscape design in

promoting health and well-being (Bill Sullivan, University of Illinois).

- Strategies for addressing legal implications and concerns for schools when they consider environmental design and programmatic changes, such as those focused on encouraging walking to school, joint use of school playgrounds, and use of food produced in school gardens. (Sara Zimmerman, National Policy and Legal Analysis Network).

#### MAKING THE CASE FOR VIBRANT, HIGH QUALITY SCHOOLYARDS

The importance of providing high-quality landscapes around a school where children can play, exercise, learn, and explore nature is becoming increasingly well recognized. Outdoor spaces allow room for

children to engage in daily active play and they provide opportunities for teachers and staff to educate children about food, gardening, and the environment. They also provide space for various other types of learning activities, such as art or music projects.

These spaces contribute to community vitality by providing green space, sun, shade, and enjoyable habitats for neighborhood residents. In many communities, the local school serves an important function as the community park, garden, central gathering place, or venue for community events. Pleasant, well-maintained schoolyards also tend to attract responsible use, which contributes to public safety.

Creating vibrant, high-quality schoolyards does not happen in isolation, however. Supportive



policies that encourage schoolyard improvements, school and community use, and ongoing maintenance must be in place. These policies include:

- Education policies allowing time in daily school schedules for outdoor activities.
- Master site plans and capital funds for major improvements to school yards.
- School district operating budgets that include sufficient funding for grounds maintenance and landscaping.
- Policies and guidelines that keep schoolyards open to the public.

- Policies that permit and encourage community gardens on schoolyards.
- Environmental policies that promote tree canopies and wildlife habitats.
- Storm water policies to reduce run-off and capture rain water in schoolyards.
- Child health protections that favor shade coverings and drinking fountains.
- Transportation and school location policies that increase school walkability and reduce busing, parking, and drop-off.

Parents, teachers, and community residents can join together to create a process for improving their local schoolyards. This process involves:

- Assessing the existing schoolyard.
- Envisioning a quality schoolyard through meetings, visits to other schools, and help from landscape architects, engineers, and designers.
- Creating a plan for an improved schoolyard and carrying it out.
- Ensuring ongoing maintenance.

These projects do not have to be large; modest projects can make a real difference, too. The essential elements of any project are a common vision, a willingness to collaborate, and a desire to create a schoolyard that contributes to the health and well-being of children and communities.

#### BUILDING THE RESEARCH BASE TO SUPPORT THE IMPORTANCE OF SCHOOL LANDSCAPES

Today's children and adults spend much of their time inside. Sufficient evidence has accumulated that the design of the built environment, including school landscaping, does

matter to health. However, to move the prevailing view of high-quality schoolyard design from "nice" to "necessary," early research efforts to build an evidence base must be expanded.

Scientific evidence demonstrating the health implications of landscape architecture is beginning to emerge. For example, a recent study compared inner city girls to their rural and suburban counterparts with regard to academic underachievement, juvenile delinquency, teenage pregnancy, and substance abuse. To avoid these problems, girls need self-discipline, defined as the ability to concentrate, inhibit impulse behavior, and delay gratification. The study authors hypothesized that one factor underlying the differences among the girls was the quantity and quality of daily exposure to green spaces, especially trees. Investigators used standardized tests of attention applied among teen girls living in urban environments with variable density and access to grass and trees. Results from all tests of all three forms of self-discipline showed that the more green the view from the girls' apartment, the higher their scores.

#### Developing Great Schoolyards A Handbook for Elementary Schools

##### KEY POINTS

- High-quality outdoor landscapes for play and learning are essential to support child health and development.
- Design-oriented guidelines to help architects and school decision-makers provide developmentally appropriate, engaging, and valuable outdoor school environments are becoming available and need to be evaluated in order to support continued improvement and widespread use.



Filardo • Slide 15



## Designing School Landscapes from Nice to Necessary

### KEY POINTS

- Research is needed to help specify features of school and neighborhood landscapes most important to children's health and well-being.
- Innovative and rigorous studies are underway to specifically measure both child well-being and academic achievement impacts of access to green space and high-quality outdoor school environments.

Similarly, the U.S. Forest Service is currently conducting a controlled clinical trial to determine whether students in high schools located in greener environments can achieve higher academic outcomes than students in schools in barren environments. This rigorous trial will provide useful data that will help designers, planners, public health experts, and community stakeholders make a convincing case that a greener environment for learning can indeed foster healthy children and better students.

### UNDERSTANDING AND OVERCOMING LEGAL BARRIERS WHEN CREATING HEALTHY SCHOOLS

Many school environment design recommendations focused on the core goals of promoting physical

activity (e.g., walking to school) or healthy eating (e.g., incorporating school-grown vegetables into lunch menus) have the potential to generate concern regarding legal issues. In practice, the need for school systems to consider first amendment, equal protection, and other constitutional issues; state law and legal authorities; and employee contract issues can act as significant barriers to full engagement in health-oriented design and programming. This is particularly true with regard to liability concerns related to playground injuries suffered during after-hour use by the community or food safety concerns related to using school garden foods in cafeteria menus. School involvement in or promotion of Safe Routes to School programs also can raise concerns about issues such as traffic injury prevention.

The irony is that many of the decisions made by school districts to avoid liability actually increase schools' risk of getting sued. If handled well, liability risks can be minimized, opening the way for schools to carry out a range of activities that promote the health and well-being of their students. State law governs injury claims against schools and other public agencies, and laws vary greatly from state to state. However, most state law gives school districts strong protections against liability. This is especially true when schools exercise reasonable care and prudently maintain their property.

It is important to emphasize that the best way to avoid liability is to avoid injuries in the first place. A school can only be held liable if it does not act with reasonable care and that carelessness causes an injury. With this in mind, schools can take several steps:

- **RELAX.** Liability risks are often exaggerated.
- **BE RESPONSIBLE.** Follow standard procedures, use reasonable care in setting up policies and running programs, and anticipate potential dangers.
- **HAVE A BACK-UP PLAN.** This means insurance.

Lessons learned from the experience of other schools suggests that

overcoming the fear of liability and encouraging shared use of school facilities by schools and communities involves learning about schools similar to one's own that have successfully engaged in the activity and getting advance approval from one's insurer. Putting risk into appropriate perspective and cultivating the desire to say "yes" also are key. Finally, putting in place policies that help people avoid injury, thereby minimizing liability risk, is essential. Policies are useful because they establish relationships and responsibilities for the parties involved, allow for consistent implementation, and provide a mechanism for documenting steps taken to minimize risk.

A Joint Use Agreement is a formal document between two entities—often a school and a county or city government—that outlines the terms and conditions for shared use of a public facility. The National Policy and Legal Analysis Network (NPLAN) has developed four model Joint Use Agreements that can be used and modified for this purpose. NPLAN also has created additional helpful resources for schools and communities interested in developing a Joint Use Agreement. These include a checklist for developing an Agreement, an overview of this type of agreement, and background materials on liability issues.

## Understanding & Overcoming Legal Barriers to Healthy Schools

### KEY POINTS

- Legal implications of health-oriented school design and programmatic initiatives, such as joint use of playgrounds after school hours, should be considered and can generally be addressed.
- Liability concerns are best addressed through improved understanding of potential issues and implementation of effective prevention strategies.
- Legal assistance organizations focused on enabling health promotion, such as the National Legal Policy and Legal Analysis Network (NPLAN), can offer valuable resources and information for school districts and other stakeholders.

### PRESENTERS

- Mary Filardo, Executive Director, the 21st Century School Fund, Washington DC • [www.21csf.org/csf-home](http://www.21csf.org/csf-home)
- William Sullivan, Professor, Department of Landscape Architecture, University of Illinois, Urbana-Champaign IL • [www.landarch.uiuc.edu](http://www.landarch.uiuc.edu)
- Sara Zimmerman, Senior Staff Attorney, National Policy and Legal Analysis Network, Public Health Law and Policy, Oakland CA • [www.phlpnet.org](http://www.phlpnet.org)



# Translating Innovation and Research Into Practice

# 4

133,000

K-12 schools, and 4,300 colleges & universities are in the U.S.

25%

of the U.S. population goes to school every day.



Integrating health-oriented design principles into the well-established green school movement represents an important mechanism for research dissemination and ongoing development.

Early examples of green health-oriented schools are beginning to emerge, offering the opportunity to use these case studies as natural experiments and the basis for broad-scale translational research opportunities.

**SESSION 4** of the workshop highlighted two examples of the real world experiences of green school designers, administrators, and advocates. These examples illustrate the challenges and opportunities of integrating health promotion into current green school design, research, and business practice:

- Case study review of the renovation of Stoddert Elementary School, an urban school in Washington, DC. The project took place in collaboration with the local Department of Parks and Recreation (Sean O'Donnell, *Perkins Eastman Architects* and Marjorie Cuthbert, *Principal, Stoddert Elementary School*).
- Overview of the U.S. Green Building Council's Center for Green Schools and its work to support school design teams, school administrators, and other stakeholders who are trying to address both health and sustainability priorities when developing cutting-edge green schools for their communities (Rachel Gutter, *Center for Green Schools*).

### TRANSFORMING A VISION INTO REALITY: STODDERT ELEMENTARY SCHOOL (WASHINGTON, DC)

Stoddert Elementary School had all the right ingredients: A location in a densely populated urban neighborhood in Washington DC. A facility surrounded by old trees and forested parkland. A student body drawn from a diverse local population including numerous Asian, European, African, and Latin American countries. A supportive parent and neighborhood community. A large adjacent playing field used by the community.

But the school, built in 1932, desperately needed renovation and modernization. So, in 2009, it closed its buildings, moved the students into trailers, and began a massive

renovation. In August 2010, the school reopened, transformed in physical characteristics and in spirit.

Today, Stoddert educates 325 PreK-5 students from 8.30am to 3.30pm. From 3.30 until 9pm, it is a lively community center, hosting athletic activities, PTA programs, and many other school and community activities. Its green features include:

- Numerous sustainable design features, such as natural ventilation, low-emitting materials and furniture, FSC-certified millwork, upgraded windows, shading devices, water use reduction features, and sensors and controls to monitor and manage lighting and HVAC.
- Pervasive natural light and views to the surrounding trees and parkland.

- Enhanced acoustics designed to reduce noise and create a calm environment for learning.
- A geothermal heating and cooling system that has reduced the facility's energy use by 31 percent.
- Corridors and design elements that create strong indoor-outdoor connections.

From the very beginning, the project's vision was that the sustainable features of the new school would provide a hands-on learning environment, allowing the children to directly study the environment, global energy issues,

and healthy nutrition and physical activity. A second fundamental principle was that the students would get to know and interact regularly with the project's designers and builders throughout the course of the renovation and afterwards.

To help ensure that the project's vision would become reality, a number of critical elements were put into place:

- **A VIBRANT PARTNERSHIP AMONG TEAM MEMBERS.** The core team—the school, the District of Columbia's Office

of Public Education Facilities Modernization, and design and construction teams—collaborated closely to plan, design, and carry out the project and its vision. The team also worked with DC Public Schools to gain “autonomy,” meaning that the school could modify the standard curriculum mandated for all district schools to incorporate environmental themes and subject matter.

- **A STRONG MEMORANDUM OF UNDERSTANDING BETWEEN THE SCHOOL AND COMMUNITY.** With the help of the DC Department of Parks and

Recreation, the school and its community neighbors developed a detailed Memorandum of Understanding that laid out how the school and its grounds could be used jointly and that delineated both parties' rights and responsibilities.

- **SUSTAINABLE DESIGN SUBJECT CONTENT BUILT INTO THE CURRICULUM.** The team went to the Green Education Foundation (GEF), a U.S. Green Building Council partner, for help in developing the school's environmental curriculum. The GEF already had

begun creating sustainable design teaching content and lessons that were aligned with the nationally used McREL Compendium of Standards and Benchmarks for K-12 Education. The Stoddert team mapped existing GEF lessons against the opportunities presented by the school's design to develop Stoddert-specific environmental curriculum content. Ultimately, the team developed at least 10 hours of green building-relevant instruction per student per year, divided equally across the school's four advisory periods.

#### SURPASSING GOALS

The Stoddert Elementary School design mandated that the project achieve a U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) Silver designation. In fact, it surpassed this certification and is a LEED Gold building. Visit [www.usgbc.org/LEED](http://www.usgbc.org/LEED) for more information on these designations.



O'Donnell • Slide 5



before

O'Donnell • Slide 8



after

### Stoddert Elementary School & Community Center

#### KEY POINTS

- Successful green school projects, such as Stoddert Elementary School, offer valuable opportunities to better understand the necessary components for effective multi-disciplinary collaborative design.
- Translating health-oriented school design strategies into real-world practice will require leveraging lessons learned from the green building movement with regard to educating and engaging the broad array of stakeholders necessary to bring a complex school building project to fruition.
- Realities of design practice, including fast pace and limited windows of opportunity for shaping the program for a school design, must be accounted for as health-oriented environmental design research efforts expand.

The lessons include regular presentations from key members of the design team, such as the architects, the mechanical engineers, and the acoustician. The school also has a GreenTouch Screen, which allows teachers and students to track the building's water and energy consumption from their classrooms and incorporate these "real-time" data into lessons.

- **AN EMPOWERED STUDENT BODY.** The school and design team have actively engaged the students in many ways to help the students feel they are owners of this exciting new school and are ambassadors of sustainable design to the larger community outside their school. Students have learned about the environmental, engineering, and conservation aspects of the school from experts and members of the design and building team, planned

the community garden with the garden project's coordinator, and discussed the indoor and outdoor learning environments with team members. An Eco-Buddies program teams 5th graders with PreK students so that the oldest students can teach and encourage the youngest. A student-led Energy Patrol monitors energy use and encourages energy-conservation measures across the school. Energy Patrol members also regularly lead campus tours for groups of visitors. These tours, which highlight 11 features of the school's sustainable design, use a guidebook developed by the 4th and 5th graders, with help from the design team and the U.S. Green Building Council.

The Stoddert Elementary School and Community Center project has yielded a number of valuable lessons learned that can inform future projects:

- **BE AWARE OF THE FAST PACE OF THE PROJECT.** The Stoddert renovation took only 19 months from start to finish, and most of the strategic decisions and research occurred in the very early phases of the project. It is difficult to accommodate new ideas or changes in direction once a project is fully underway, so stakeholders must intervene early if they want to influence a project.

### THE U.S. GREEN BUILDING COUNCIL'S CENTER FOR GREEN SCHOOLS

Through its many initiatives, the Center for Green Schools provides a forum to engage a diverse array of stakeholders, including the people who make the case (those who pursue and advocate for green schools), the people who make the decisions (government officials and policy makers), and the people who get things done (designers, architects, and school officials).

Survey and focus group results indicate that although Americans support a federal investment in schools, the buildings themselves are not foremost when they think about education. The design, planning, and public health communities must make better connections between sustainability, health and wellness, and academic achievement. They also must widely disseminate these findings.

The Center for Green Schools develops programs to engage stakeholders and publicize results of projects in order to foster the productive conversations that are needed to increase the visibility of sustainable design and build support for incorporating health parameters into school design. Currently, thousands of projects are underway to build or renovate schools. A key question, therefore, is how this body of current projects can be used to inform research and innovation. A clear opportunity exists to introduce LEED credits focused on health in the areas of water, indoor air quality, and use of materials. In addition, new classes of credits focused on features such as edible schoolyards or green cafés could possibly provide a rich research resource for school-based obesity prevention going forward.

- **ASK FOR HELP.** The Stoddert team reached out to the U.S. Green Building Council and its GEF for help in incorporating environmental content into its new curriculum and in creating the guidebook that students use when conducting tours. The school also worked with a gardening expert when it created the community garden. Bringing in expertise as needed can enrich a project.

- **ACKNOWLEDGE THE VALUE AND CHALLENGES OF INVOLVING DIVERSE STAKEHOLDERS.** The Stoddert project involved many players—school officials, the design team, contractors, DC government officials, parents, and community representatives. Balancing the opinions, needs, and demands of a diverse group of stakeholders can be challenging at times, but a final product valued by all requires the active participation of all.



#### PRESENTERS

- Sean O'Donnell, Architect, Perkins Eastman, Washington DC • [www.perkinseastman.com/Default.aspx](http://www.perkinseastman.com/Default.aspx)
- Marjorie Cuthbert, Principal, Stoddert Elementary School, Washington DC • [www.stoddert.org/](http://www.stoddert.org/)
- Rachel Gutter, Director, The Center for Green Schools, U.S. Green Building Council, Washington DC • [www.centerforgreenschools.org/home.aspx](http://www.centerforgreenschools.org/home.aspx)





# Innovative Tools for Green Health Design Research

# 5

## 46%

annual growth the wireless consumer fitness & wellness device market is expected to have from 2010–2016.

## 35%

of cell phone users now have smartphones.

Achieving the vision of at-scale development and translation of evidence-based green and healthy school design will require innovation in data resources, analytic methodologies, and research partnerships.

Fortunately, new information resources, surveillance methods, and analytic approaches that are well suited to address the often unique requirements of multi-scale environmental design research are emerging across public health and design disciplines.

**SESSION 5** of the workshop highlighted three new multi-disciplinary tools with important implications for green health environmental design research:

- New complex systems modeling techniques that allow investigators to explore human systems in ways that incorporate numerous actors, scales, and factors (Ross Hammond, *Brookings Institution*).
- The Green Building Information Gateway (GBIG), developed by the U.S. Green Building Council, which provides a platform for researchers to analyze the distribution, features, and performance of planned and ongoing green building projects (Chris Pyke, *U.S. Green Building Council*).

- A proposed research information system based on “distributed sensor networks,” which harnesses new mobile technology data resources for physical activity assessment, monitoring, and research (James McClain, *National Cancer Institute*).

### USING COMPLEX SYSTEMS MODELING TO FURTHER HEALTH-FOCUSED ENVIRONMENTAL DESIGN

Several attributes of the childhood obesity epidemic make it especially challenging to study and combat. These include the various levels of influence involved (from individual behaviors to community characteristics to national policies), the substantial diversity of relevant actors, and the multiplicity of mechanisms implicated. These heterogeneous factors, which interact in multiple and nonlinear

ways to strongly influence the behavior of individuals, families, and communities, are characteristic of a complex adaptive system. Traditional tools, which approach a problem from one disciplinary perspective or seek solutions at only one level, are often inadequate for addressing complex adaptive systems because they are unable to fully capture the multiplicity of interactions and influences inherent in such systems.

Complex systems modeling, which is widely used in social and biological sciences, but is new to public health, is one tool that may be uniquely suited to studying the complex adaptive system of childhood obesity. This tool’s ability to uncover and account for the epidemic’s underlying heterogeneous and nonlinear factors, may give investigators a greater ability to identify which areas may be most amenable to policy action or program intervention.

Agent-based modeling is one form of systems modeling that has emerged recently with advances in computing. In this type of modeling, investigators construct an “artificial society” in which each actor in the system is represented in computer code. The actors are placed in a spatial context and given a set of rules to govern their interactions. Their interactions and decision processes are documented at both the individual and aggregate levels. Investigators can calibrate the model by comparing its patterns to actual data.

Agent-based modeling can be a valuable tool in health-focused environmental design because it can represent spatial relationships effectively and integrate a broad variety of data types at multiple scales. Agent-based modeling can accommodate the great diversity of the elements in the system because each element is individually modeled. Moreover, it





### Complex Systems Modeling and Health-focused Policy & Design

#### KEY POINTS

- Complex systems modeling offers an innovative approach to analyzing environmental determinants and potential design-based interventions for obesity because it can incorporate the many levels of effect from individual biology to community design features.
- Agent-based modeling offers a compelling tool for generating hypotheses and analyzing complex varieties of data with regard to the use of environmental design as an obesity prevention strategy due to its ability to account for feedback loops between spatial scales and across data types.
- Expanded availability of training programs to produce qualified systems science researchers will be required to fully realize the potential of this important tool for health-oriented environmental design.

can incorporate complex feedback dynamics and multiple spatial contexts. These abilities are often critical in designing an intervention in a complex system, such as a school set within a community.

Before investing in this type of modeling, investigators should understand the types of research questions (such as an investigation of interdependent behaviors that evolve over time) or conditions (such as when testing in the real world is not feasible) for which agent-based modeling is most appropriate or useful. Investigators also should be realistic about its challenges. Agent-based modeling requires certain types of data, which may not be available. Sufficient resources must be available to support the interdisciplinary teams and high computational demands required to conceptualize, develop, and test these models. Finally, it may be difficult to find researchers and model designers who have sufficient training and expertise to construct these models.

If all these conditions are met, however, agent-based modeling may be helpful in answering a number of questions relevant to health-focused green building design, such as:

- How might the interior layout and features of a school building affect the health, social dynamics, and other factors of the children and adults who use the building?

- What potential effects might a specific school building site have on the obesogenic environment of the neighborhood?
- What are the implications of a particular distribution of school buildings for a city's health and sustainability?
- How can combinations of several small changes in the interior and/or exterior of existing schools work together synergistically to produce large shifts in health and education outcomes?

### GREEN BUILDING INFORMATION GATEWAY: DEVELOPING DATA SYSTEMS FOR ENVIRONMENTAL DESIGN RESEARCH

Through its LEED certifications and other programs, the U.S. Green Building Council focuses on shifting practice trends within the building industry (design, development, operation) to better incorporate sustainability principles. To be truly successful, this shift must be empirical and data driven. Green building practices, as encapsulated in LEED ratings, represent a designated set of practices intended, and in essence hypothesized, to achieve intended outcomes. As such, the LEED system (along with other green building certification systems) is well positioned to provide the basis for experiments that measure

the impact of modifications in building practice on energy use and sustainability. Conducting such experiments and analyzing the resulting data can yield insights and understanding that can be used to further develop sustainable design.

However, it is well understood within the green building industry that understanding only the energy performance of buildings is not sufficient. It also is important to measure and optimize the human experience of a building. The challenge is how to produce human experience data for green buildings in a useful form and at sufficient scale to enable this vision of green buildings as testable hypotheses.

The U.S. Green Building Council's Green Building Information Gateway (GBIG) is a first attempt at this type of data system. GBIG provides a data infrastructure that unpacks LEED criteria into data that can be linked and compared with data from other sources. For example, LEED data from projects in a particular locality can be compared with walkability data from Walk Score and other geographic and demographic data from companies that provide geographic information systems (GIS) data, such as ESRI. It also allows a framework for distributed data collection systems that make use of mobile devices and other social media inputs. GBIG provide an intriguing new vehicle for collecting real-time, spatially-

based subjective (and in some cases objective) feedback about the human experience performance of buildings.

Current projects that incorporate green building designs provide a wealth of real-world experiments. Emerging information platforms like GBIG can help design and building teams create and test hypotheses and analyze information to make the best use of these experimental opportunities.

### EXPLORING DISTRIBUTED SURVEILLANCE SYSTEMS FOR PHYSICAL ACTIVITY MONITORING

Traditional approaches for measuring health behaviors, such as physical activity monitoring, use highly centralized methodologies that emphasize standardized procedures and control over the information collected. However, the development of computer technologies, smartphones, and wireless devices has opened opportunities for new approaches to collecting behavioral data through distributed surveillance systems (see for example, Asthmapolis, <http://asthmapolis.com>, a novel remote monitoring and surveillance system that collects data on asthma inhaler use).

Distributed surveillance systems maximize the ability to scale up (increase data volume and sample size) as well as scale out

### Green Building Experiments Concepts and Emerging Tools

#### KEY POINTS

- Achieving the goal of shifting real estate practices toward sustainable and healthy design, building, and operational practices will require data on both the energy and human experience performance of green buildings. The U.S. Green Building Council's pilot system, the Green Building Information Gateway (GBIG), is a first attempt to provide a framework for organizing and accessing these types of information for investigation.
- Each green building that undergoes certification through systems like LEED offer the potential of a hypothesis-driven natural experiment because design strategies intended to achieve measurable outcomes are carefully itemized.
- The majority of current green building research focuses on energy performance. However a clear and growing opportunity exists to investigate the impact of health-oriented design strategies using information systems such as GBIG.

## Leveraging Distributed Sensor Networks for Physical Activity Assessment, Monitoring & Research

### KEY POINTS

- The increasing availability of mobile devices and inexpensive sensor systems offers a new opportunity to collect health behavior information using distributed surveillance techniques.
- Distributed surveillance systems are particularly relevant to environmental design research, given their ability to both scale up.
- Pilot frameworks to organize and distribute data from distributed sensor networks is underway through initiatives such as the Physical Activity Remote Technology Network to Enable Research Scalability (PARTNERS).

(increase geographic reach and sociodemographic diversity). This unique flexibility could be particularly important for the field of environmental design research given that it has a greater need for geographic diversity than do other forms of experimental inquiry.

The potential sample population accessible by distributed surveillance is remarkable. It is estimated that 35 percent of cell phone users now have smartphones (82.2 million devices), with an average of 586,000 new users per week. The wireless consumer fitness and wellness device market is expected to have a 46% annual growth from 2010 to 2016, with 80 million devices sold annually by

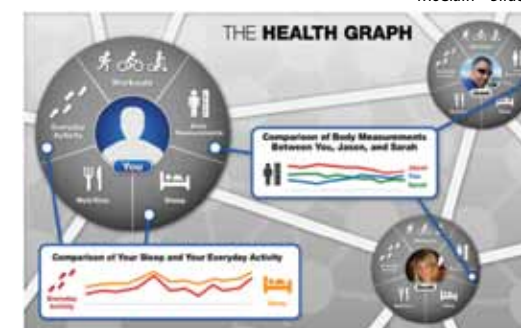
2016. Therefore, the challenge is not to create incentives to encourage people to use this technology. Rather, it is how to develop the “back end” database infrastructure that can collect these data and aggregate them in some useful form for analysis.

Several efforts are underway to encourage the development of an infrastructure to help support the development of distributed surveillance systems. These include a 2010 National Cancer Institute Small Business Innovation Research (SBIR) grant entitled “Development of Software Systems for Automated Storage, Analyses, and Reporting of Objective Behavioral Measures” and the formation of Physical Activity

McClain • Slide 14



McClain • Slide 16



McClain • Slide 15



Remote Technology Network to Enable Research Scalability (PARTNERS), a distributed network of physical activity sensor technology users who share data for behavioral health monitoring and research.

Understanding the dynamic interaction of children with their environments in schools provides a clear example of how data collected from distributed surveillance systems could provide an important complement to traditional measurement methodologies. Increasingly, schools are being adapted for wireless technologies, which allows distributed sensor networks to be used and encourages new thinking about alternative data collection, storage, and analysis methods. Possible devices and applications include:

- Low-cost sticker-sized sensors that could be used to detect

motion; data are aggregated through a networked base station (see for example, Green Goose, [www.greengoose.com](http://www.greengoose.com)).

- A “School Health Dashboard” that would visualize the dynamic interaction of students with the school environment. This device could allow students and staff to evaluate their physical activity trends and enable behavior change interventions.
- Electronic tablets with applications to collect self-report data. Such a device could provide local-level data for surveillance and policy purposes, and data could be tracked and compared by class, school, district, or geographic area. Through programming with informatics and social games, the device also could promote positive physical activity behavior change.

## DESIGNING COMMUNITIES AND SCHOOLS TO PROMOTE HEALTH



### PRESENTER

Andrew Dannenberg, Consultant to Healthy Community Design Initiative, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta GA • [www.cdc.gov/nceh](http://www.cdc.gov/nceh)

A growing body of evidence demonstrates that factors associated with the built environment have an enormous impact on health. The challenge therefore is to design and build green, sustainable, and healthy environments for our homes, schools, and communities.

A number of tools have been used to create momentum for incorporating green health principles and practices and to help communities build and promote healthy built environments:

- Green Building Frameworks, such as LEED for Neighborhood Development. This rating system integrates the principles of smart growth, urbanism, public health, and green building into the first national standard for neighborhood design.

- Web-based resources for general use, such as Walk Score ([www.walkscore.com](http://www.walkscore.com)), a website that rates the walkability of specific locations. Walk Score can be added to real estate listings to assist homebuyers in their decision-making.
- Decision support tools, such as Health Impact Assessment (HIA). HIAs are a systematic process that uses an array of data sources, analytic methods, and stakeholder inputs to determine the potential effects of a program (e.g., a local walk to school program), policy (e.g., paid sick leave policy), or project (e.g., a new community school or highway corridor redevelopment) on the health of a population and the distribution of those effects within the population.



### PRESENTERS

- Ross Hammond, Senior Fellow, Brookings Institution, Washington DC • [www.brookings.edu/experts/hammond](http://www.brookings.edu/experts/hammond)
- Chris Pyke, Vice President for Research, U.S. Green Building Council, Washington DC • [www.usgbc.org](http://www.usgbc.org)
- James McClain, Physical Activity Epidemiologist, Risk Factor Monitoring and Methods Branch, Applied Research Program, National Cancer Institute, Bethesda MD • <http://riskfactor.cancer.gov/areas/physical>



# Increasing Capacity for Green Health Research and Practice

# 6

# 143,000

students are affected by the U.S. Green Building Council's Green School Fellows program.

# 22

states and one tribal government are funded through CDC's School Health Program.



Translating green health environmental design research into widespread practice will require an investment in developing professional capacity and resources across public health, design, and school management.

Most public health professionals have limited interaction with those who make decisions about the built environment, such as urban planners, designers, zoning boards, city councils, school boards, and others. At the same time, few design and planning professionals are trained to comprehensively anticipate and evaluate the health implications of design, land use, or transportation decisions.

**SESSION 6** of the workshop highlighted three examples of innovative training and capacity building efforts:

- The Built Environment and Public Health Curriculum (Nisha Botshway, *Georgia Institute of Technology*).
- The Center for Green Schools Fellowship Program (Anisa Baldwin-Metzger, *U.S. Green Building Council*).
- The Healthy School Program (Allison Nihiser, *Centers for Disease Control and Prevention*).

## THE BUILT ENVIRONMENT AND PUBLIC HEALTH CURRICULUM

In 2006, participants at the American Public Health Association's Annual Meeting met for a session entitled

“Teaching the Built Environment–Health Connection.” This session gave participants a chance to discuss how to create a model curriculum that would integrate the built environment and health disciplines. This curriculum was designed and described in a 2009 article in the *American Journal of Preventive Medicine*. The curriculum provides students with an understanding of the interactions between the built environment and health and it give them skills to engage these issues as professional planners, public health practitioners, and other related professionals.

A website, Built Environment + Public Health Curriculum ([www.bephc.com](http://www.bephc.com)), has been developed to house the curriculum. It provides lesson plans, readings, and assignments for faculty and other users who wish to

teach the curriculum. The website also provides guidance on how the curriculum can be offered as a full semester course, individual units, a single class module, or even an individual assignment.

In addition to the curriculum, [www.bephc.com](http://www.bephc.com) provides a wealth of information about built environment and public health educational opportunities at colleges and universities that are members of the Association of Collegiate Schools of Planning. This includes a “tier” framework that ranks the availability of integrated design and public health training among institutions. Tiers range from availability of individual classes focused on health oriented design up to dual-degree offerings in public health and design disciplines. Users can search for information by school or by type of program. This



### Integrated Training Programs in Design, Urban Planning & Public Health

#### KEY POINTS

- The need for an interdisciplinary workforce able to apply both design and public health perspectives is increasingly well-recognized.
- Resources such as the Built Environment + Public Health Curriculum (hosted at [www.bephc.com](http://www.bephc.com)), which provide teaching materials and information regarding university offerings for interested students, are becoming increasingly available.

website clearly demonstrates that the number of resources available in this field is growing and that training of professionals with this kind of interdisciplinary expertise is evolving.

### THE U.S. GREEN BUILDING COUNCIL'S GREEN SCHOOL FELLOWS PROGRAM

The Green School Fellows Program, a pilot program launched in New Orleans in 2008 in the aftermath of Hurricane Katrina, provides school districts with a fully-funded, dedicated expert who collaborates with district leadership to bring sustainable and environmentally responsible practices into schools. The Fellows provide guidance and comprehensive training and resources to help school districts see how sustainable building initiatives can save money and resources while at the same time providing a healthy learning environment for students and staff.

The program already has seen substantial success in New Orleans. Like her effects on the rest of the city, Hurricane Katrina's effects on the New Orleans public schools were devastating:

- All the schools were closed, most for the entire 2005–2006 school year.

- Students were dispersed throughout the state and country.
- Facilities had approximately \$2 billion in damages related to the storm.
- More than 50 school campuses were completely destroyed.
- Facilities incurred approximately \$89 million in damages due to vandalism and theft following Katrina.
- Facilities had approximately \$133 million in termite and mold-related damages both before and after Katrina.

As a result of rebuilding efforts, 20 LEED-certified schools are now open or under construction in New Orleans, and facility operations and maintenance practices have improved significantly. Currently, 3 school districts around the country with more than 143,000 students participate in the U.S. Green Building Council's Green School Fellows program, which is funded by United Technologies. The U.S. Green Building Council is hoping to expand the program to include 500 to 1,000 Fellows and is interested in the potential for collaborating with public health partners to use the program as a platform for integrated green health school-based research.



### CDC'S HEALTHY SCHOOL PROGRAM

A third potential platform and resource for building capacity for school-based green health research and programs is the Center for Disease Control and Prevention's Healthy School Program. This program conducts surveillance and monitoring of school-aged populations. It also funds and partners with state, local, and tribal education agencies, health agencies, and non-governmental agencies to promote the health and well-being of children and adolescents. These programs are carried out within the context of a coordinated school health approach.

The program's surveillance and monitoring initiatives include:

- Youth Risk Behavior Surveillance System (YRBSS), which surveys high school students every 2 years to monitor priority health-risk behaviors, including overweight and obesity, dietary behaviors, and physical activity and sedentary behaviors.
- School Health Policies and Practices Study (SHPPS), which assesses school health policies and practices at all levels, from state to classroom, and monitors school health program components. This survey is conducted every 6 years.

### The Center for Green Schools Fellowship Program

#### KEY POINTS

- The U.S. Green Building Council's Green School Fellows program places fully-funded dedicated experts in school districts across the United States to help foster sustainable practices.
- The Green School Fellows program currently has 300 participants but is intended to be expanded to between 500 and 1,000 participants in future years.
- The U.S. Green Building Council is strongly interested in collaborating with public health partners to use this unique platform to build capacity for integrated green health school-based research efforts.

### School Health at CDC: Obesity, Physical Activity, and Nutrition

#### KEY POINTS

- The CDC Healthy School program offers a variety of data, information, and programmatic resources that can help support the development of school-based green health collaborative efforts with partners such as the U.S. Green Building Council's Center for Green Schools.



#### PRESENTERS

- Nisha Botchwey, Associate Professor, School of City and Regional Planning, College of Architecture, Georgia Institute of Technology • [www.planning.gatech.edu](http://www.planning.gatech.edu)
- Anisa Baldwin-Metzger, Green School Fellows Program, U.S. Green Building Council, Washington DC • [www.centerforgreenschools.org/fellowship](http://www.centerforgreenschools.org/fellowship)
- Allison Nihiser, Health Scientist, National Center for Chronic Disease Prevention and Health Promotion, U.S. Centers for Disease Control and Prevention, Atlanta GA • [www.cdc.gov/chronicdisease/index.htm](http://www.cdc.gov/chronicdisease/index.htm)

- School Health Profiles (SHP), a system of surveys that assess school health policies and practices in states, large urban school districts, territories, and tribal governments. The surveys are conducted every 2 years.

Findings from these surveys are analyzed, synthesized, and disseminated through a variety of channels for a variety of purposes. Products include research synthesis documents and school health guidelines to promote healthy eating and physical activity. The School Health Program also develops tools, such as the School Health Index, the PECAT and HECAT, the Youth Physical Activity Guidelines Toolkit, and Making It Happen, to help schools meet current health recommendations.

A second major initiative of CDC's School Health Program is funding 22 states and one tribal government so that they can help school districts and schools address physical activity, healthy eating, and tobacco through coordinated school health programs. CDC also funds national nongovernmental organizations, such as the National Association for Sport and Physical Education, Action for Healthy Kids, the National

School Boards Association, and the American Cancer Society, to establish and maintain policy, systems, and environmental change strategies for obesity prevention and coordinated school health. A final function of the Program is to evaluate promising school-based practices. Results help CDC identify strong systematic approaches for successfully implementing coordinated school health efforts.

The School Health Program's initiatives provide a number of potentially fruitful areas for collaboration, including:

- Using SHPPS data to inform green health initiatives.
- Offering school-based obesity prevention expertise to inform green building groups interested in integrating their efforts with public health activities.
- Providing information resources and tools for green building professionals such as U.S. Green Building Council's Green Schools Fellows program participants.
- Promoting green building activities and programs, such as the Green Schools Fellows Program, with potential for public health collaboration through the CDC's

# Appendices

APPENDIX 1: Green Health Workshop Sponsors

APPENDIX 2: Green Health Workshop Agenda

APPENDIX 3: Green Health Workshop Participants

APPENDIX 4: Websites, Materials, and Other Resources

---

## APPENDIX 1

### Green Health Workshop Sponsors

#### **NATIONAL COLLABORATIVE FOR CHILDHOOD OBESITY RESEARCH**

[nccor.org](http://nccor.org)

The National Collaborative on Childhood Obesity Research (NCCOR) brings together four of the nation's leading research funders — the Centers for Disease Control and Prevention, (CDC), the National Institutes of Health (NIH), the Robert Wood Johnson Foundation (RWJF), and the United States Department of Agriculture (USDA) — to address the problem of childhood obesity in America. NCCOR focuses on efforts to identify and evaluate effective interventions, with an emphasis on those that affect high-risk populations and communities. NCCOR programs specifically seek to: a) increase and improve national, state, and local surveillance of childhood obesity; b) improve the ability of childhood obesity researchers and program evaluators to conduct research and program evaluation; and c) provide national leadership to accelerate implementation of evidence-informed practice and policy.

#### **NATIONAL ACADEMY OF ENVIRONMENTAL DESIGN**

[naedonline.org](http://naedonline.org)

Created by more than 20 nonprofit organizations, the National Academy of Environmental Design (NAED) represents more than 500,000 members. People involved in NAED activities come from both industry and academia and are among the world's most knowledgeable in their field. The NAED membership provides the leadership and expertise required to accomplish complex research projects related to the role of environmental design at multiple scales on issues such as climate change, resource depletion, and energy security. The NAED's Design+Health initiative focuses on the human health implications of environmental design and seeks to improve integration, advancement, and translation of health-focused multi-disciplinary research.

#### **U.S. GREEN BUILDING COUNCIL CENTER FOR GREEN SCHOOLS**

[centerforgreenschools.org](http://centerforgreenschools.org)

The U.S. Green Building Council is a 501(c)(3) nonprofit community of members, chapters, advocates, and practitioners working to improve human health, support economies and protect the environment through green buildings. The Center for Green Schools creates programs, resources, and partnerships to accelerate the transformation of schools and campuses. From public schools to private schools, community colleges to four-year institutions, the Center supports and integrated, system-wide approach to sustainability across the education community. While each school's path will be different, the core commitment of K-12 schools, colleges, and universities to create green buildings, curriculum, and communities transcends school type, size and location. High-performing schools result in high-performing students, and the Center works directly with staff, teachers, faculty, students, administrators, elected officials, and communities to drive the transformation of all schools into sustainable places to live, learn, work, and play.

# APPENDIX 2

## Green Health Workshop Agenda

www.nccor.org/greenhealthworkshop



# AGENDA

**WEDNESDAY, OCTOBER 26, 2011 (PRE-WORKSHOP WELCOME & RECEPTION)**  
**LOCATION:** U.S. Green Building Council (USGBC) Headquarters  
 6:00–8:00PM Welcome & Reception (hours of USGBC offices available)

**THURSDAY, OCTOBER 27, 2011**  
**LOCATION:** American Institute of Architects (AIA) Headquarters, Boardroom

8:30–8:45	Welcome & Framing Comments	Matthew Trowbridge University of Virginia / NIH
8:45–10:15	<b>Session 1: School Context &amp; Neighborhood Connection</b>	
	Development of EPA School Siting Guidelines	Matthew Dalbey U.S. Environmental Protection Agency
	Promoting Active Transportation to School	Noreen McDonald UNC-Chapel Hill
	Active Design at the City & Neighborhood Scale	Jack Robbins Perkins+WBB
	Moderated Group Discussion	
10:15–10:30	Break	
10:30–12:00	<b>Session 2: Green &amp; Healthy School Buildings</b>	
	Designing Healthy School Food Environments (Case Study: Buckingham Elementary School)	VMDO Architects Charlottesville, VA
	Evaluating Impact of School Design on Childhood Obesity	Terry Huang Nebraska Medical Center
	Behavioral Economics (nudging) & School Cafeteria Design	Adam Brumberg Cornell Food & Brand Lab
	Evidence-based School Interior Design for Learning & Health	Caren Martin University of Minnesota
	Moderated Group Discussion	
12:00–12:30	Lunch	
12:30–1:00	Keynote: Designing Communities & Schools to Promote Health	Andy Dannenberg Centers for Disease Control



www.nccor.org/greenhealthworkshop

1:00–2:30	<b>Session 3: School Playgrounds &amp; Gardens</b>	
	Development of School Playground Design Guidelines	Mary Flanks 21st Century School Fund
	Designing School Landscapes to Promote Health & Well-being	Bill Sullivan University of Illinois
	Schoolyards & Gardens as Community Resources: Legal Perspective	Sara Zimmerman National Policy and Legal Analysis Network (NPLAN)
	Moderated Group Discussion	
2:30–2:45	Break	
2:45–4:15	<b>Session 4: Translating Innovation &amp; Research into Practice</b>	
	Green & Healthy Schools: Building a Case, Getting Things Done	Rachel Cutler U.S. Green Building Council
	Architectural Practice Perspective	Sean O'Donnell Perkins Eastman
	School Administration & Facility Planning Perspective	Margie Culbert Boulder Elementary
	Moderated Group Discussion	
4:15–4:30	Wrap-up & Framing for Friday	
<b>FRIDAY, OCTOBER 28, 2011</b>		
<b>LOCATION:</b> U.S. Green Building Council, Boardroom		
9:00–9:15	Summary of Day 1 & Framing Comments	Matthew Trowbridge University of Virginia / NIH
9:15–11:00	<b>Session 5: New Tools for 'Green Health' Design Research</b>	
	Complex Systems Modeling & Health-focused Environmental Design	Ross Hammond Brookings Institute
	USGBC Green Building Information Gateway	Chris Pyke U.S. Green Building Council
	Distributed Sensor Networks for Physical Activity Tracking	James McClain National Institutes of Health
	Moderated Group Discussion	Kevin Patrick UC - San Diego
11:00–11:15	Coffee Break	
11:15–12:15	<b>Session 6: Increasing Capacity for 'Green Health' Research &amp; Practice</b>	
	USGBC Green School Fellows Program	Anita Balderin-Metzger U.S. Green Building Council
	CDC Healthy School Program	Allison Nilsen Centers for Disease Control
	Integrated Training Programs in Design, Urban Planning & Public Health	Heba Botway University of Virginia
12:15–12:45	Lunch	
12:45–1:15	Keynote: Pedestrian Safety of School Children – Toward Improving Walkability of Inmax City Neighborhoods	Trish Baranick University of Southern California
1:00–2:30	<b>Session 7: Workshop Synthesis &amp; Next Steps</b>	
	Framing Comments for Group Discussion	Richard Jackson MS, MPH
2:30–2:45	Summary & Closing	



## APPENDIX 3

### Green Health Workshop Participants

**LINDSAY BAKER**

University of California, Berkeley

**ANISA BALDWIN-METZGER**

U.S. Green Building Council

**RACHEL BALLARD-BARBASH**

National Cancer Institute,  
National Institutes of  
Health (NIH)

**TRIDIB BANERJEE**

University of Southern California

**THOM BANKS**

American Society of Interior  
Designers

**DAVID BERRIGAN**

National Cancer Institute, NIH

**NISHA BOTCHWEY**

Georgia Institute of Technology

**HEATHER BOWLES**

National Cancer Institute, NIH

**MARGOT BROWN**

U.S. Environmental  
Protection Agency

**ADAM BRUMBERG**

Cornell University

**MARJORIE CUTHBERT**

Stoddert Elementary School

**LAURIE CYNKIN**

U.S. Centers for Disease  
Control and Prevention

**MATTHEW DALBEY**

U.S. Environmental  
Protection Agency

**ANDY DANNENBERG**

U.S. Centers for Disease  
Control and Prevention

**STEVE DAVIS**

VMDO Architects

**IHAB ELZEYADI**

University of Oregon

**LAYLA ESPOSITO**

National Institute of Child Health  
and Human Development, NIH

**AMANDA EWING**

U.S. Department of Agriculture

**MARY FILARDO**

21st Century School Fund

**TOM FISHER**

University of Minnesota

**GILMAN GRAVE**

National Institute of Child Health  
and Human Development, NIH

**SUBHRAJIT GUHATHAKURTA**

Georgia Institute of Technology

**JOANNE GUTHRIE**

U.S. Department of Agriculture

**RACHEL GUTTER**

U.S. Green Building Council

**ROSS HAMMOND**

Brookings Institution

**BECKY HOKE**

U.S. Green Building Council

**TERRY HUANG**

University of Nebraska  
Medical Center

**JENNIFER HUGHES**

National Endowment for the Arts

**NANCY HUVENDICK**

21st Century School Fund

**MARCIA KARGBO**

U.S. Environmental  
Protection Agency

**SHARON KIRKPATRICK**

National Cancer Institute, NIH

**SUSAN KREBS-SMITH**

National Cancer Institute, NIH

**JOYCE LEE**

New York City Department of  
Design & Construction

**LISA MANCINO**

U.S. Department of Agriculture

**CAREN MARTIN**

University of Minnesota

**JAMES MCCLAIN**

National Cancer Institute, NIH

**NOREEN MCDONALD**

University of North Carolina,  
Chapel Hill

**BJ MCDUFFIE**

FHI 360

**ROBIN MCKINNON**

National Cancer Institute, NIH

**TREVOR MILLER**

University of Minnesota

**YEELI MUI**

FHI 360

**ALLISON NIHISER**

U.S. Centers for Disease Control  
and Prevention

**SEAN O'DONNELL**

Perkins Eastman Architects

**DEBORAH OLSTER**

Office of Behavioral and Social  
Sciences Research, NIH

**MIRA PANEK**

U.S. Green Building Council

**KEVIN PATRICK**

University of California,  
San Diego

**SUSAN PIEDMONT-PALLADINO**

National Building Museum

**CHRIS PYKE**

U.S. Green Building Council

**JASMINE HALL RATLIFF**

Robert Wood Johnson  
Foundation

**JILL REEDY**

National Cancer Institute, NIH

**MARIE RIENZO**

FHI 360

**JACK ROBBINS**

Perkins + Will

**ANNE RODGERS**

FHI 360

**SAMEER SIDDIQI**

National Cancer Institute, NIH

**DINA SORENSEN**

VMDO Architects

**LINDA SORRENTO**

National Academy of  
Environmental Design,  
U.S. Green Building Council

**JEFF SOULE**

American Planning Association

**FRITZ STEINER**

University of Texas, Austin

**BILL SULLIVAN**

University of Illinois

**DIONNE TOOMBS**

U.S. Department of Agriculture

**MATTHEW TROWBRIDGE**

University of Virginia

**LORI TUGMAN**

American Society of Interior  
Designers

**JENNY WIEDOWER**

U.S. Green Building Council

**SARA ZIMMERMAN**

National Policy & Legal  
Analysis Network to Prevent  
Childhood Obesity

## APPENDIX 4

### Green Health Workshop Websites, Materials, and Other Resources

PRESENTATION	RESOURCES
<b>School Context and Neighborhood Connection</b>	
Insights from Development of EPA School Siting Guidelines (Dalbey)	EPA's School Siting Guidelines <a href="http://www.epa.gov/schools/siting/index.html">www.epa.gov/schools/siting/index.html</a>
Rethinking the Relationship of School Location and Mode of Travel (McDonald)	McDonald NC, Brown AL, Marchetti LM, Pedroso MS. U.S. school travel, 2009: An assessment of trends. <i>Am J Prev Med</i> 2011;41(2):146-51.
Using Community Design to Improve Public Health (Robbins)	Active Design Guidelines. New York City Department of Design and Construction <a href="http://www.nyc.gov/adg">www.nyc.gov/adg</a>
<b>Green and Healthy School Buildings</b>	
Exploring the Potential of "Choice Architecture" to Influence Healthy Choices in School Lunchrooms (Brumberg)	The Cornell Center for Behavioral Economics in Child Nutrition Programs <a href="http://www.SmarterLunchrooms.org">www.SmarterLunchrooms.org</a>
Designing School Interiors for Learning and Health (Martin)	Informed Design: Where Research Informs Design <a href="http://www.informedesign.org">www.informedesign.org</a>

PRESENTATION	RESOURCES
<b>School Playgrounds and Gardens</b>	
Making the Case for Vibrant, High Quality Schoolyards (Filardo)	Developing Great Schoolyards: A Handbook for Elementary Schools. The 21st Century School Fund, with funding by The Prince Charitable Trusts <a href="mailto:info@21csf.org">info@21csf.org</a>
Building the Research Base to Support the Importance of School Landscapes (Sullivan)	<ul style="list-style-type: none"> <li>Ding et al. Neighborhood environment and physical activity among youth. <i>Am J Prev Med</i> 2011;41(4):442-55.</li> <li>Colabianchi et al. Features and amenities of school playgrounds: A direct observation study of utilization and physical activity levels outside of school time. <i>Int J Behav Nut Phys Act</i> 2011;8:32.</li> <li>Dyment et al. Grounds for movement: Green school grounds as sites for promoting physical activity. <i>Health Ed Res</i> 2008;23(6):952-62.</li> <li>Faber Taylor A, Kuo FE, Sullivan WC. Views of nature and self-discipline: Evidence from inner-city children. <i>Environ Psychol</i> (Special Issue: Environment and Children) 2002;22(1-2):49-63.</li> </ul>
Understanding and Overcoming Legal Barriers when Creating Healthy Schools (Zimmerman)	Checklist for Developing a Joint Use Agreement. The National Policy and Legal Analysis Network (NPLAN), a project of Public Health Law & Policy. <a href="http://www.nplan.org">www.nplan.org</a>

## APPENDIX 4 CONTINUED

PRESENTATION	RESOURCES
<b>Translating Innovation and Research Into Practice</b>	
Overview of The USGBC Center for Green Schools	<ul style="list-style-type: none"> <li>The U.S. Green Building Council's Green Education Foundation <a href="http://greeneducationfoundation.wordpress.com/tag/usgbc">http://greeneducationfoundation.wordpress.com/tag/usgbc</a></li> <li>USGBC Center for Green Schools <a href="http://www.centerforgreenschools.org">www.centerforgreenschools.org</a></li> </ul>
<b>Improved Tools for Green Health Design Research</b>	
Using Complex Systems Modeling to Further Health-focused Environmental Design (Hammond)	Hammond RA. Complex systems modeling for obesity research. <i>Prev Chronic Dis</i> 2009;6(3):A97. <a href="http://www.cdc.gov/pcd/issues/2009/jul/09_0017.htm">http://www.cdc.gov/pcd/issues/2009/jul/09_0017.htm</a>
Building an Information Gateway to Bolster Green Building Research (Pyke)	<ul style="list-style-type: none"> <li>Green Building Information Gateway <a href="http://www.GBIG.org">www.GBIG.org</a></li> <li>Walk Score <a href="http://www.walkscore.com">www.walkscore.com</a></li> <li>ESRI <a href="http://www.esri.com">www.esri.com</a></li> </ul>
Using Distributed Sensor Networks to Track Physical Activity (McLain)	<ul style="list-style-type: none"> <li>Asthmapolis <a href="http://asthmapolis.com/how-it-works">http://asthmapolis.com/how-it-works</a></li> <li>Green Goose <a href="http://www.greengoose.com">www.greengoose.com</a></li> </ul>

PRESENTATION	RESOURCES
<b>Increasing Capacity for "Green Health" Research and Practice</b>	
The Built Environment and Public Health Curriculum (Botchwey)	<ul style="list-style-type: none"> <li>Botchwey ND et al. A model curriculum for a course on the built environment and public health. <i>Am J Prev Med</i> 2009;36(2 Suppl):S63-S71.</li> <li>Built Environment + Public Health Curriculum <a href="http://www.bephc.com">www.bephc.com</a></li> </ul>
The U.S. Green Building Council's Green School Fellows Program (Nihiser)	The Center for Green Schools: Green School Fellows <a href="http://www.centerforgreenschools.org/fellowship">www.centerforgreenschools.org/fellowship</a>
CDC's Healthy Schools Program	Healthy Schools Program <a href="http://www.cdc.gov/healthyyouth/schoolhealth">www.cdc.gov/healthyyouth/schoolhealth</a>



## ACKNOWLEDGEMENTS

### CONFERENCE ORGANIZERS

**Matthew Trowbridge MD MPH**  
University of Virginia School  
of Medicine  
*NCCOR*

**Nisha Botchwey PhD MPH**  
Georgia Institute of  
Technology School of City  
and Regional Planning  
*NAED*

**Tom Fisher**  
University of Minnesota  
College of Design  
*NAED*

### NCCOR GREEN HEALTH WORKING GROUP

Matthew Trowbridge (*NIH*)

Jill Reedy (*NIH*)

Sharon Kirkpatrick (*NIH*)

Sameer Siddiqi (*NIH*)

Layla Esposito (*NIH*)

Jay Variyam (*USDA*)

Lisa Mancino (*USDA*)

Tom Schmid (*CDC*)

Andy Dannenberg (*CDC*)

Tracy Orleans (*RWJF*)

Sara Zeigler (*CDC*)

Sarah Lee (*CDC*)

