This annotated bibliography updates research compiled in volumes one through three of the Children & Nature Network (C&NN) research resources, with an emphasis on research published in 2008-2009 in two primary areas: 1) benefits to children from contact with nature and 2) children’s experience of nature. The studies selected for this annotated bibliography are either reports of original research or syntheses of existing research. All studies meet criteria for scholarly excellence. This document includes a summary of each research report, information on author affiliations, a full citation, and information on each document’s availability. While this bibliography includes many notable studies, it is not exhaustive and recommendations are welcome on additional research to include. Please send suggestions to the attention of Cheryl Charles, Ph.D., President and CEO, Children & Nature Network, Cheryl@childrenandnature.org.

**Update: Benefits to children from contact with nature**

This section reviews research from 2008-2009 focused on the physical, mental, and social benefits that contact with nature provides to children. This section also highlights research on related factors that provide insight on this topic. Research is grouped into several main focal areas.

**Greenspace supports children’s quality of life**

Bell and colleagues critically review the last 10 years of research that has examined relationships between greenspace and quality of life. Major areas reviewed in this report are: health and well-being, social and community value, economic value/impacts, environmental value, and planning and design. Research related to children is one of the main topics highlighted in the various sections of this report. In their review, Bell and
colleagues also discuss their criteria for article inclusion, highlight methodological limitations of studies conducted to date, and identify key research gaps.

Author Affiliation: The authors are with the OPENspace research center in the UK.


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**Time spent outdoors supports many aspects of children’s health**

In this report, Muñoz reviews literature concerning the linkage between spending time outdoors and health, with a primary emphasis on research related to children. She reviews research and policy related to outdoor use and health more generally and then takes an in-depth look at topics related to children’s use of the outdoors and relationships to their health. Specific topics Muñoz examines include research linking children’s time spent outdoors to increased physical activity, healthy development, and overall well-being. She also examines research related to the design of children’s play spaces, access to natural spaces, the use of outdoors in children’s education, and research related to people and factors that constrain and enable children’s outdoor play. Finally, in concluding her literature review, Muñoz identifies methodological considerations, research gaps, and provides suggestions for advancing knowledge in this area.

Author Affiliation: Muñoz is with the Sustainable Development Research Centre in Scotland.


Readers may also be interested in the following related report:


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**Focus: School Performance & Learning**

These articles examine relationships between children’s outdoor-related behavior at school and their school performance and learning.

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**Children’s classroom behavior is better if they have recess**

Recess provides one of the few opportunities for children to engage in free play and physical activity at school and to potentially be outdoors. Barros and colleagues investigated the amount of recess 8- to 9-year-old children have in the U.S. and compared the classroom behavior of children who receive and do not receive daily recess. The researchers analyzed data from a nationally representative sample of over 10,000 third-grade children in public and private schools. As part of this study, a wide range of data was collected, including interviews with children and surveys of teachers,
parents, and school administrators. In analyzing the data, Barros and colleagues found that 30% of children had no recess at all or less than a 15 minute daily break. The researchers found that children with less than 15 minutes of recess a day were significantly more likely to be black or Hispanic, live in a large- or medium-sized city, live in the South, attend public school, and come from families with lower income and less parental education. In examining school behavior, Barros and colleagues found that teachers’ rating of overall classroom behavior was better for children with some recess as compared to those with none/minimal break, however, the frequency and amount of recess was not significant. While data from teachers could be biased due to their feelings about recess, this study provides valuable information about the amount of recess 8- to 9-year-old children receive and relationships to classroom behavior.

Author Affiliation: The authors are with the Children’s Hospital at Montefiore and Rose F. Kennedy Center in New York.

Barros, R. M., Silver, E. J., & Stein, R. E. K. (2009). School recess and group classroom behavior. *Pediatrics, 123*(2), 431-436. This study may be available in a library near you or can be purchased online through the publisher at: [http://www.jpeds.com/](http://www.jpeds.com/)

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**Allocating time to physical activity in school does not negatively impact academic achievement**

Over the years, there has been much discussion about the benefits and drawbacks of allocating time to physical activity in schools. In this article, Trudeau and Shepherd review the literature with regard to the relationships between physical education, school-based physical activity, school sports, and academic performance. Based on their review of a number of quasi-experimental and cross-sectional studies, the authors conclude that physical activity can be added to the school curriculum without negatively impacting children’s academic achievement. The authors highlight literature which indicates that additional time spent in physical activity may in fact result in small increases in students’ grade point averages and more efficient learning in the classroom. In addition, Trudeau and Shepherd summarize studies that have found positive associations between physical activity in school and children’s physical fitness, concentration, memory, behavior, and school satisfaction. The authors summarize supporting mechanistic evidence from the neurosciences and highlight the need for additional research to further clarify relationships between academic performance and school-based physical activity.

Author Affiliation: Trudeau is with the Université du Québec à Trois-Rivières in Canada. Shephard is with the University of Toronto in Canada.

Trudeau, F., & Shephard, R. J. (2008). Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity, 5*, 12. This study may be available in a library near you or can be purchased online through the publisher at: [http://www.ijbnpa.org/](http://www.ijbnpa.org/)

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**School gardens positively impact children’s learning and behavior**

Gardening takes place in many schools throughout the nation. Blair reviews research in the U.S. on school gardening and its relationship to children’s learning and behavior.
She begins her review by highlighting the range of reasons why school gardens exist, which include providing children experiences with natural ecosystems, enhancing children’s understanding of food systems, helping children develop environmental attitudes and behaviors, and serving as a basis for experiential learning. Blair then reviews quantitative and qualitative studies on the impact of school gardening on children’s learning and behavior. Of the 12 quantitative studies reviewed, she found that 9 of the 12 studies found significant and positive impacts of gardening with regard to test measures, which included children’s science achievement and food consumption behavior. Of the 7 qualitative studies reviewed, Blair found a number of commonalities among study findings, including that students enjoyed and were highly motivated by gardening; students demonstrated improved school attitude and pride in the garden; and gardening enhanced student bonding, teamwork, and learning opportunities. In addition, she reviewed studies that evaluated principals’ and teachers’ opinions about school gardens. Based on her review of the literature, Blair determined that, overall, current research indicates that gardening can have a positive impact on student achievement and behavior. She also discusses the methodological limitations of current studies and provides recommendations for future research.

Author Affiliation: Blair is with Penn State University.

Blair, D. (2009). The child in the garden: an evaluative review of the benefits of school gardening. Journal of Environmental Education, 40(2), 15-38. This study may be available in a library near you or can be purchased online through the publisher at: http://www.heldref.org/pubs/jee/about.html

**Natural views from high school positively impact students’ academic achievement and behavior**

Matsuoka examined the relationship between views of nature and high school students’ academic achievement and behavior. To investigate this relationship, he inventoried the landscape features of 101 high school campuses in southeastern Michigan and assessed student access to these features via building characteristics and school policies (e.g., through window size and the ability to eat lunch outdoors). Matsuoka also gathered information about each school’s student academic achievement and conduct (e.g., the percentage of merit award winners and graduation rates). In analyzing the data, he found that landscape and access characteristics were significantly associated with student academic achievement and behavior. For example, Matsuoka found that schools with larger windows and more views of natural elements had students with higher standardized test scores, higher graduation rates, and a greater percentage of students planning to attend college, as well as fewer reports of criminal behavior. He also found that schools that allowed students to eat outside or off campus had higher test scores and a greater percentage of students planning to attend college. In examining specific landscape features, Matsuoka found that trees and shrubs needed to be relatively close to the students to provide academic achievement and behavior benefits. Importantly, Matsuoka controlled for a number of socio-demographic and general school characteristics in his analyses. While this study may be limited due to its cross-sectional design and focus on school-level information, it provides valuable insight into the benefits of natural views to high school students with implications for school design and policy.
Real field trips provide better overall learning environments than virtual field trips

Learning today often involves the use of technology. In this study, Harrington compares 12 nine- to eleven-year-old students’ experiences on a real and virtual field trip. Two groups of students (6 each) from a Pittsburgh public elementary school went on a real and virtual field trip to a local wildflower reserve. Data were gathered from knowledge tests, video and audiotape recordings, photographs, interviews, surveys, and observations. In analyzing the data, Harrington found that while more students preferred the virtual field trip, students felt that they learned more from the real field trip. In examining the field trips with regard to curriculum learning impact, however, she found no differences between the two trips in terms of children’s performance on a specific knowledge post-test. In terms of participants’ views, Harrington found that students’ reported that the real field trip was better than the virtual field trip with regard to learning, inquiry, and presence. With regard to the other dimensions examined—exploration, desire to create, sense of excitement, level of curiosity, desire to re-experience, sense of calm, desire to share, awe and wonder, assessment of beauty, level of frustration, and disinterest—she found no statistical difference in student ratings between the real and virtual field trips. Many students reported that they liked “spotting plants” or “being in the context of the environment” on the real field trip, while students reported that they liked the “ability to fly” or “use their imagination” on the virtual field trip. Overall, Harrington found that the real field trip provided a chance for students to use all their senses and for spontaneous events to occur and instigate investigation and learning (e.g., finding a salamander), while the virtual field trip provided students with new views of the environment and enabled individual exploration. As a result of this study, Harrington concluded that a virtual field trip can be used successfully as part of a curriculum, but that a real trip provides a superior learning environment that goes beyond specific curriculum-based learning. While this study may be limited due to its small sample size, it provides important insight into the complementary value of real and virtual-based learning opportunities, as well as ideas on how to improve both types of experiences for students.

Author Affiliation: Harrington is with the University of Pittsburgh.

Harrington, M. C. R. (2009). An ethnographic comparison of real and virtual reality field trips to Trillium Trail: the salamander find as a salient event. *Children, Youth and Environments, 19*(1), 74-101. This article is available online at: [http://www.colorado.edu/journals/cye/index_issues.htm](http://www.colorado.edu/journals/cye/index_issues.htm).

**Focus: Physical Activity & Weight**

These articles investigate linkages between the design of children’s environments, children’s outdoor-related behavior, and their physical activity and weight.
Older children who spend more time outside tend to be more physically active and are less likely to be overweight

Cleland and colleagues investigated whether the amount of time children spend outdoors is related to their physical activity levels and being overweight. About 200 five- to six-year-old and 350 ten- to twelve-year-old children from 19 randomly selected elementary schools in Melbourne, Australia participated in this study. In 2001 and 2004, parents reported the amount of time their children spent outdoors and researchers recorded children’s physical activity levels using an accelerometer and measured children’s weight and height. In their paper, Cleland and colleagues report many findings, some of which are discussed below. The researchers found, for example, that children spent significantly more time outdoors during warmer months as compared to cooler months; boys had significantly higher levels of moderate and vigorous physical activity (MVPA) on weekdays than girls; the prevalence of overweight increased significantly between 2001 and 2004 for both younger and older children, as well as boys and girls; and among the older children, boys generally spent significantly more time outside than girls. Cleland and colleagues also found that older children who spent more time outside were generally more physically active and had a lower prevalence of overweight than children who spent less time outside. For example, the researchers found that each additional hour older girls spent outside during the cooler months was associated with an extra 26.5 minutes per week of MVPA and that each additional hour older boys spent outside during the cooler months was associated with an extra 21 minutes of MVPA. When examining changes over the three-year period, Cleland and colleagues found that the more time older girls and boys spent outside on weekends at baseline (2001), the higher their MVPA on weekends at follow-up (2004). In addition, the researchers found that in 2004, the prevalence of overweight among older children was 27-41% lower for those children who spent more time outside in 2001. With regard to younger children, Cleland and colleagues found few associations between time spent outdoors, physical activity, and overweight. While this study may be limited due to its reliance on parental self-report of children’s time spent outside, the cross-sectional and longitudinal nature of this study and objective measurement of physical activity provide an important contribution to the literature. The results of this study suggest that encouraging 10- to 12-year-old children to spend more time outdoors may help increase physical activity levels and reduce the prevalence of overweight.

Author Affiliation: Cleland, Crawford, Hume, Timperio, and Salmon are with Deakin University in Australia. Baur is with the University of Sydney in Australia.

Cleland, V., Crawford, D., Baur, L. A., Hume, C., Timperio, A., & Salmon, J. (2008). A prospective examination of children’s time spent outdoors, objectively measured physical activity and overweight. *International Journal of Obesity, 32*(11), 1685-1693. This study may be available in a library near you or can be purchased online through the publisher at: [http://www.nature.com/ijo/index.htm](http://www.nature.com/ijo/index.htm)

Green school grounds improve quantity and quality of elementary school children’s physical activity

In recent years, there has been increasing interest in greening school grounds to diversify children’s play experiences, such as through the planting of trees, building of ponds, and development of vegetable gardens. Dyment and Bell investigated how green school grounds affect the physical activity of elementary school children by
sending questionnaires to a diversity of Canadian schools that had greened their school grounds. Questionnaires were completed by 105 individuals from 59 schools who had been involved in their school’s greening project. In analyzing the study data, Dyment and Bell found that green areas were an important place for physical activity: respondents reported that 66% of students use green areas for active play. Interestingly, the researchers found that green areas tended to support more moderate and light activity as opposed to the more vigorous activity that generally takes place in traditional turf and asphalt areas. Dyment and Bell found that nearly 50% of the respondents reported that their school ground promotes more vigorous activity after greening, while about 70% reported more moderate and/or light physical activity taking place after greening. In addition, the researchers found that 90% of respondents reported that their school ground appeals to a wider variety of student interests after greening; 85% reported that their school ground now supports a wider variety of play activities; and 84% reported that since greening, their school ground encourages more exploration of the natural world. While this study may be limited due to its reliance on retrospective self-report, it provides important insight into the benefits of green school grounds and their potentially significant role in complementing more traditional school ground areas and improving the quality and quality of elementary school children’s physical activity.

Author Affiliation: Dyment is with the University of Tasmania in Australia. Bell is with Evergreen in Canada.

Dyment, J. E., & Bell, A. C. (2008). Grounds for movement: green school grounds as sites for promoting physical activity. Health Education Research, 23(6), 952-962. This study may be available in a library near you or can be purchased online through the publisher at: http://her.oxfordjournals.org/

**Schoolyard size and landscape quality influence children’s satisfaction and weight**

Outdoor school grounds are an important environment to consider when striving to promote children’s physical activity and reduce childhood obesity. In this study, Ozdemir and Yilmaz investigate linkages between the physical characteristics of children’s schoolyard environments and their attitudes, physical activity, and body mass index (BMI). The researchers interviewed nearly 300 3rd and 4th grade students, as well as teachers, and administrators in five public schools in Ankara, Turkey. Ozdemir and Yilmaz also measured students’ weight and height, and had professionals assess the schoolyard environment based on factors such as size, material, vegetation cover, and maintenance. Although schoolyards differed, the researchers found that students generally had no direct contact with vegetation and that the amount of outdoor space was limited given the number of students using the space. While most students were satisfied with their schoolyard, which the researchers speculate may be due to acclimation, unsatisfied students highlighted the lack of trees and greenery as the primary reason for their dissatisfaction. Among their many findings, Ozdemir and Yilmaz report that the size of the schoolyard was significantly related to students’ BMI, with students in larger yards having lower BMI values than students in smaller yards. The researchers also found that yard landscape characteristics were significantly associated with children’s BMI values, but in the opposite direction than expected: students from schools with “advanced” landscape features had higher BMI values than students from
schools with “low” landscape features, although BMI values were still in the normal range. While this study may be limited due to its relatively small sample size and reliance on self-report measures, it highlights the importance of participatory and well-thought-out school landscape design, as well as the need for adequate financing and maintenance of schoolyards.

Author Affiliation: The authors are with Ankara University in Turkey.

Ozdemir, A., & Yilmaz, O. (2008). Assessment of outdoor school environments and physical activity in Ankara’s primary schools. *Journal of Environmental Psychology, 28*(3), 287-300. This study may be available in a library near you or can be purchased online through the publisher at: http://www.elsevier.com/wps/find/journaldescription.cws_home/622872/description#description

*Children in greener neighborhoods have lower body weight changes*
Bell and colleagues examined the medical records of 4,000 three- to sixteen-year-old children that lived in Marion County, Indiana, received care from a particular clinic network between 1996 and 2002, had height and weight measurements for two consecutive years, and lived at the same residential address for at least two years. The majority of participants in this study were non-Hispanic black and enrolled in Medicaid (an indicator of socioeconomic status). Bell and colleagues geo-coded each participant’s address using a Geographic Information System and measured greenness at these locations using satellite images and a vegetation index. The researchers speculated that neighborhood greenness might serve as an indicator of children’s access to spaces that promote physical activity or increased time outside. In analyzing the study data, Bell and colleagues found that the amount of vegetation in a child’s neighborhood was inversely correlated with their Body Mass Index (BMI) score at the year two measurement. That is, in general, the more vegetation a child had in their neighborhood, the lower their body weight changes. The researchers also found that children in more vegetated settings were less likely to have a higher BMI over 2 years as compared to children in less vegetated settings. Importantly, Bell and colleagues controlled for a number of other factors in their analyses, such as residential density. While the study is observational and thus cannot causally link neighborhood greenness and body weight changes, this research highlights the role that neighborhood vegetation could play in policies and programs aimed at preventing childhood obesity.

Author Affiliation: Bell is with the University of Washington. Wilson is with Indiana University-Purdue University. Liu is with Indiana University.

Bell, J. F., Wilson, J. S., & Liu, G. C. (2008). Neighborhood greenness and 2-year changes in Body Mass Index of children and youth. *American Journal of Preventive Medicine, 35*(6), 547-553. This study may be available in a library near you or can be purchased online through the publisher at: http://www.ajpm-online.net/

*Community design can promote and support children’s physical activity*
This article is a policy statement by the American Academy of Pediatrics’ Committee on Environmental Health regarding the influence that community design has on children’s opportunities to be physically active. The Committee highlights the role of neighborhood design in promoting recreational and incidental or “utilitarian” physical activity, such as
the availability of parks and recreational facilities, as well as children’s ability to walk to school. The Committee also highlights important factors influencing children’s physical activity, including traffic danger, the presence of sidewalks, and perception and fear of crime. Finally, the Committee provides a number of specific recommendations for pediatricians and government to promote children’s physical activity in the built environment and support more active lifestyles.


**Children with a park playground near their home are more likely to be of a healthy weight**

Physical activity is thought to play an important role in childhood obesity. While research results to date are somewhat mixed, parks can provide important opportunities for children to be physically active. In this study, Potwarka and colleagues examine whether children’s weight is related to park space and the availability of specific park facilities within 1km of children’s homes. Researchers collected information on 108 two-to seventeen-year-old children from four neighborhoods in a mid-sized city in Ontario, Canada. Parents reported their child’s height and weight, while researchers used a Geographic Information System to assess park space for each child and a database and trained observers to assess park facilities. In analyzing the study data, Potwarka and colleagues found that proximity to park space was not significantly related to children’s weight status. The researchers did find, however, that when examining park facilities, children with a park playground within 1 km of their homes were five times more likely to be of a healthy weight than children without a park playground near their homes. While this study may be limited due to its relatively small sample size, reliance on parental report, and focus on availability as opposed to actual use of park space, this study provides valuable insight into the potential importance of children’s proximity to specific park facilities as opposed to park space in general.

Author Affiliation: The authors are with the University of Waterloo in Canada.


**Public open space features may influence children’s physical activity**

Public open spaces may be important places for children to play and be physically active. Timperio and colleagues investigated relationships between the specific features of public open spaces and children’s physical activity by examining data collected as part of a neighborhood study in Melbourne, Australia. Participants in this study included 163 eight- to nine-year-old children and 334 thirteen- to fifteen-year-old children. Participants wore an accelerometer for one week to measure their physical activity and researchers used a Geographic Information System and trained observer to identify and analyze the closest public open space to each child’s home. In analyzing the data,
Timperio and colleagues found that younger children spent significantly more time engaged in moderate to vigorous physical activity (MVPA) on weekdays and weekends as compared to adolescents. While there were no gender differences among younger children, among adolescents researchers found that boys spent significantly more time engaged in MVPA on weekdays and weekends as compared to girls. With regard to public open space, Timperio and colleagues found that participants, on average, lived about 300 meters from their closest public open space. When examining relationships between features of children’s closest public open space and physical activity, researchers obtained somewhat mixed and inconsistent results. For example, researchers found that playgrounds were positively associated with younger boys’ weekend physical activity, the number of recreational facilities was inversely associated with younger girls’ physical activity after school and on the weekend, and the presence of trees and signage regarding dogs were positively associated with adolescent girls’ physical activity after school. While this study provides one of the few examinations of public open space features and children’s physical activity, additional research is needed to better understand children’s actual use of public open space and the quantity and quality of public open space features.

Author Affiliation: Timperio, Crawford, Andrianopoulos, Ball, Salmon, and Hume are with Deakin University in Australia. Giles-Corti is with the University of Western Australia.

Timperio, A., Giles-Corti, B., Crawford, D., Andrianopoulos, N., Ball, K., Salmon, J., et al. (2008). Features of public open spaces and physical activity among children: findings from the CLAN study. Preventive Medicine, 47(5), 514-518. This study may be available in a library near you or can be purchased online through the publisher at: www.elsevier.com/locate/amepre

**Neighborhood recreation facilities positively influence children’s physical activity levels**

Tucker and colleagues examined children’s physical activity levels in relation to several neighborhood environmental factors and parents’ perceptions of recreation opportunities. Over 800 eleven- to thirteen-year-old children in London, Ontario completed a questionnaire regarding their physical activity levels on the preceding day. In addition, parents completed a questionnaire evaluating their child’s home environment and researchers used a Geographic Information System to analyze each child’s neighborhood environment. In analyzing the data, Tucker and colleagues found that, on average, children engaged in about 160 minutes of physical activity a day. In addition, researchers found that neighborhood recreational opportunities significantly and positively influenced children’s physical activity levels. For example, Tucker and colleagues found that children with two or more recreation facilities in their neighborhood engaged in almost 17 more minutes of physical activity after school as compared to children with less than 2 recreation facilities and were almost 2 times as likely to be in the upper quartile for after school physical activity. Importantly, researchers controlled for a number of other factors in their analyses, including season and demographic factors. Tucker and colleagues also found that land use mix and percentage of park coverage did not significantly influence children’s physical activity levels. While this study is cross-sectional in nature, relied on self-report, and focused on quantity and not quality of recreation facilities, it provides valuable insight into how neighborhood recreation opportunities may influence children’s physical activity levels.
Adolescents’ local environments influence their physical activity and food consumption

Eating well and being physically active are important to good health and well-being. In this article, Tucker and colleagues review the impact of home, school, and neighborhood environments on adolescents’ food behavior and physical activity, and investigate adolescents’ perceptions of these environments. As part of this study, researchers interviewed 60 twelve- to fourteen-year-old adolescents in focus groups in London, Ontario, Canada. Tucker and colleagues analyzed the content of information discussed in each focus group to understand influences on participants’ food consumption and physical activity. Researchers found that schools, nearby parks, and recreation facilities, as well as other structural opportunities around homes (e.g., yards and other kids) influenced adolescents’ physical activity and served as both a facilitator and barrier to their physical activity. For example, the majority of adolescents reported using parks often, however, some participants commented on the small size of local parks, amount of garbage, and the lack of opportunities for older children. Tucker and colleagues also found that adolescents identified the availability of fast-food restaurants, convenience stores, and other restaurants as impacting their food consumption and that a number of participants identified the lack of healthy foods in their schools and neighborhoods. While this study may be limited due to its small sample size and reliance on volunteers, it offers important insight into the local environment’s influence on adolescents’ physical activity and food consumption.

Author Affiliation: Tucker is with the Middlesex-London Health Unit in Canada. Irwin and Gilliland are with the University of Western Ontario in Canada. He is with the University of Texas at San Antonio.

Tucker, P., Irwin, J. D., Gilliland, J., & He, M. (2008). Adolescents’ perspectives of home, school and neighborhood environmental influences on physical activity and dietary behaviors. Children, Youth and Environments, 18(2), 12-35. This article is available online at: [http://www.colorado.edu/journals/cye/index_issues.htm](http://www.colorado.edu/journals/cye/index_issues.htm).
Focus: Other Health Benefits
These articles highlight other benefits from children’s contact with nature, including physical, psychological, and social health benefits. In addition, one article highlights potential risks associated with limited exposure to sunlight.

Green School Gyms improve children’s health
BTCV is a charitable organization in the United Kingdom that created Green Gyms to improve people’s health and the environment. As part of Green Gyms, individuals participate in a range of conservation and gardening projects outdoors, such as planting trees and constructing footpaths. From 2007 to 2009, BTCV implemented Green Gyms in 9 primary schools. As part of these School Green Gyms, a weekly 1 to 1.5 hour session was provided for 10 weeks for groups of about 10 children at each school. During these sessions, children participated in environmental activities on their school grounds or nearby open spaces. BTCV commissioned a university to evaluate the School Green Gyms. As part of this evaluation, children completed a questionnaire before and after participation in the program. In analyzing the data, researchers found that children’s psychosocial health and overall health significantly improved after the Green Gyms program. In addition, they found that children’s weekend physical activity levels significantly increased after the program and that children felt very positive about the program. While the study data is based on self-reported information and it is difficult to separate the impact of the program activities from the outdoor context, this evaluation provides valuable information about the impact of an innovative program on children’s health.

BTCV. (2009). Evaluation findings: health and social outcomes 2009. BTCV. This report is available online at: http://www2.btcv.org.uk/display/greengym_research

Children benefit from appropriate risk-taking during outdoor play
Play is critical to children’s healthy development. Little and Wyver examine outdoor play with a focus on early childhood education and urban Western culture. The authors review a number of social and environmental factors that have influenced children’s outdoor play experiences in recent years (e.g., traffic, lack of space, other time demands, and parental fears). Little and Wyver discuss the importance of children’s experience with risk to healthy development, including children’s ability to develop and refine their motor skills and enjoy and gain confidence in being physically active. The authors also review literature related to the impacts of not providing children with opportunities to engage in challenging and risk-related experiences, including children’s engagement in inappropriate risk-taking and underdevelopment of decision-making skills related to making sound risk judgments. Little and Wyver discuss the inability of many early childhood educators to provide challenging and stimulating outdoor experiences to children due to restrictive regulations and a cultural emphasis on eliminating or minimizing physical risk. The authors review the difference between “hazard” and “risk” and emphasize the importance of considering risk within the larger context of children’s development, as well as the need to focus on identifying and fostering a risk balance that is appropriate for each individual child. In concluding their
article, Little and Wyver articulate a model they developed that illustrates possible pathways from specific factors (e.g., poor outdoor environments or fear of litigation) to minimization of risk-taking and developmental outcomes, and emphasize the need to examine early childhood education policy and practice.

Author Affiliation: The authors are with Macquarie University in Australia.


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**Many U.S. children are vitamin D deficient and this deficiency is associated with cardiovascular risk factors**

Vitamin D is primarily produced in the skin after exposure to sunlight and is essential for calcium absorption and may be important to numerous other body processes. In this study, Kumar and colleagues investigated the prevalence of vitamin D deficiency among U.S. children and whether vitamin D deficiency is associated with cardiovascular risk factors. The researchers analyzed data for nearly 10,000 children from the 2001-2004 National Health and Nutrition Examination Survey (NHANES), a nationally representative survey of the U.S. population where participants were interviewed and given physical examinations. In analyzing the data, Kumar and colleagues found that 9% of 1- to 21-year-old children were vitamin D deficient, representing 7.6 million U.S. children, and 61% were vitamin D insufficient, representing 50.8 million U.S. children. In examining factors associated with vitamin D deficiency, researchers found that children who were older, female, non-Hispanic black or Mexican American, obese, drank milk less than once a week, did not take vitamin D supplements, and were engaged in more than 4 hours of screen time a day, were more likely to be vitamin D deficient. In addition, Kumar and colleagues found that vitamin D deficiency was associated with a number of cardiovascular risk factors, including higher systolic blood pressure and higher lipoprotein cholesterol, when compared to children without vitamin D deficiency. While this study may be limited due to its cross-sectional design, Kumar and colleagues’ work using a large, nationally representative sample provides valuable information on an understudied topic.

Author Affiliation: Kumar, Kaskel, and Melamed are with the Albert Einstein College of Medicine in New York. Muntner is with the Mount Sinai School of Medicine in New York. Hailpern is with the Centers for Disease Control and Prevention.


Readers may also be interested in the following related articles:
Focus: Outdoor Behavior

How much time children spend outside and the activities that they engage in while outside affect their contact with nature. These articles examine children’s outdoor behavior, including time spent outside, outdoor activities, and influencing factors.

New survey tracks children’s outdoor behavior

Despite growing interest in children’s outdoor behavior, we know very little about how much time children spend outdoors. In 2007, Cordell and colleagues started the National Kids Survey to improve our understanding of how much time children spend outdoors and the activities that they engage in while outside. Data is collected via a random-digit-dialed telephone survey of the general population. As part of this survey, researchers interview a parent/guardian of children under 16-years-old or 16- to 19-year-old teenagers to gather information on outdoor behavior. To date, the survey has been implemented two times—fall-summer 2007/08 and summer-spring 2008/09. In analyzing data from these surveys, Cordell and colleagues present a number of findings in a series of three reports. A few of the researchers’ key findings include: 1) over the two survey periods, about 61% of children were reported to spend two or more hours outdoors on a typical weekday and about 77% were reported to spend two or more hours outdoors on a typical weekend day; 2) more younger children (6- to 15-years-old) were reported to spend 2 or more hours outdoors as compared to older children (16- to 19-years-old) and more Hispanic children were reported to spend 4 or more hours per day outdoors on weekends as compared to white or black children; 3) the most popular outdoor activity reported was “just playing or hanging out outdoors” at 83% followed by “biking, jogging, walking, skate boarding, etc.” at 79%; 4) almost 40% of respondents reported that children spent more time outside now as compared to the same time last year; and 5) in examining changes between survey periods, there was a slight, but statistically significant decline in the percentage of children that spent no time outdoors on weekend days. While this study may be limited due to its reliance on self or proxy report, it provides an important contribution to the literature as it is collecting and examining data on a large number of children over multiple years. Additional data are needed to make robust conclusions about changes in children’s time spent outside and to understand factors causing any observed trends.

Author Affiliation: Cordell and Betz are with the USDA Forest Service. Green is with the University of Georgia.
Children’s activities outside of school are similar across nations
Singer and colleagues surveyed 2400 mothers of 1- to 12-year-old children in sixteen nations about their attitudes and beliefs regarding their children’s play and well-being, as well their children’s activities outside of school. Participating mothers were from a diversity of socioeconomic backgrounds, urban to rural areas, and developed to developing countries. Despite this diversity, Singer and colleagues found many similarities in mothers’ responses. In their article, the researchers present many findings. A few of their key overall findings include: 1) the most common activity that children were reported to engage in outside of school was watching television, with 72% of mothers reporting that their child participated in this activity; 2) 58% of mothers reported that their child played outdoors; 3) 54% of mothers reported that playing outside was the activity their children enjoyed most; 4) 73% of mothers reported that their child would rather play outside than inside; 5) 47% of mothers were concerned that their children do not spend enough time playing outside; and 6) 72% of mothers agreed that children are growing up too quickly today. The researchers also analyzed survey data in terms of country development status, child gender, child age, and family characteristics, among other factors. For example, Singer and colleagues found that significantly more boys than girls played outside and participated in organized sports, and children with more siblings were reported to play outside more than children with fewer siblings. In addition, researchers found that mothers from rural areas were significantly more likely to report that their children participated in rough and tumble play or explored nature as compared to mothers from city and suburban areas. While this survey may be limited due to its reliance on proxy and self-report, it provides an important contribution to the literature because of its relatively large sample size and unique focus on mothers from a diversity of nations.

Author Affiliation: Singer and Singer are with Yale University. D’Agostino and DeLong are with StrategyOne in New York

Singer, D. G., Singer, J. L., D’Agostino, H., & DeLong, R. (2009). Children’s pastimes and play in sixteen nations. American Journal of Play (Winter). This study may be available in a library near you or can be purchased online through the publisher at: www.americanjournalofplay.org/

Youth participation in outdoor activities declined in 2007
The Outdoor Foundation in cooperation with partner organizations commissioned a survey in 2008 to examine American’s participation in outdoor activities in 2007. As part of this survey, researchers conducted over 40,000 online interviews with individuals and households from around the nation. If a person took part in one or more of 35 identified outdoor activities (e.g., running, biking, fishing, and hiking) at least once during 2007, he or she was considered to have participated in outdoor recreation. Researchers weighted gathered data to ensure that it reflected the U.S. population as a whole. In their report, the Outdoor Foundation discusses many findings. Some of the key findings with regard to youth include: 1) youth participated in outdoor recreation more than any other age...
group and participated with greater frequency, however, there is much room for improvement as 42% of youth participated in outdoor activities less than 30 times a year; 2) when compared to participation in 2006, in 2007 there was over an 11% drop in outdoor activity participation among 6- to 17-year-old children (from 66% to 55%); 3) participation among 6- to 12-year-old girls and boys changed from 2006 to 2007 with boys dropping from 79% to 72% in their participation, while girls dropped from 77% to 61% in participation, leading to a larger gap between boys and girls in their outdoor recreation participation; 4) for 6- to 17-year-old children, the primary motivation reported for starting participation in outdoor activities was parents, friends, family, and relatives; 5) participation in outdoor activities declined with age; and 6) “fun” was the most common motivation youth provided for participating in outdoor activities, while “lack of interest” was the primary reason for not participating in outdoor activities. While this survey provides important information on American’s participation in outdoor activities and is based on a large, representative sample, the survey method used did change from 2007 to 2008 and thus could influence comparisons between 2006 and 2007 data. Additional data will improve our understanding of any observed trends in outdoor activity participation.


Outdoor play behavior has changed between today’s generation of children and their parent’s generation

While it is often suggested that children today have less contact with nature than in previous generations, little quantitative information is available. In 2009, Natural England commissioned England Marketing to conduct an online survey of adults and children in England to better understand nature contact between today’s generation of children and their parent’s generation. A total of 1150 adults and 502 seven- to eleven-year-old children participated in the online survey. In their report, England Marketing discusses a number of findings. A few of their key findings include: 1) 62% of children reported playing at home or a friend’s home more than any other place, whereas adults reported playing outdoors in local streets the most when they were children; 2) less than 10% of children today reported playing in natural places, whereas 40% of adults reported playing in such places when they were young; and 3) 41% of children reported that playing indoors is their favorite place to play, whereas only 16% of adults reported that playing indoors was their favorite place to play as children. In addition, with regard to “freedoms” to play, England Marketing found that 29% of adults reported that they do not allow their children to play unsupervised outdoors, 81% of children reported wanting more freedom to play outside, and 85% of adults reported that they would like their children to be able to play in natural spaces without supervision. While this survey relied on self-reported information and it is challenging to compare children’s current activities with adults’ memories of their childhood activities, this survey provides valuable information on a topic that has received limited attention.

Children’s active free play in their neighborhoods is complex

Veitch and colleagues investigated where children engage in active free play in their neighborhoods and factors that influence their active free play. Over 200 eight- to twelve-year-old children from schools located in a range of socioeconomic areas in Melbourne, Australia completed a mapping activity and survey about their active free play behaviors, such as places where they ride or walk in their neighborhood without an adult. In this article, Veitch and colleagues discuss numerous findings, some of which are reported below. For example, researchers found that, overall, children reported being most active in their yard at home, followed by the park/playground and a friend’s/relative’s yard. With regard to distance from children’s homes to the closest and most often visited park, Veitch and colleagues found that, on average, children traveled 590 meters to reach their closest park and 1736 meters to reach the park they usually visited. In examining children’s independent mobility, researchers found that 36% of children reported being able to go to over three places without an adult and being able to walk or cycle more than 1000 meters from their home without an adult. Importantly, for each of the primary areas investigated, Veitch and colleagues found significant gender, age, and/or socioeconomic differences. For example, researchers found that girls reported being more active in their yard at home than boys, children from low socioeconomic areas reported having to travel more than 2 to 2.5 times further to get to their closest or usually visited park than children from high socioeconomic areas, and more children from low socioeconomic areas reported that they could travel more than 1000 meters from home without an adult as compared to children from mid and high socioeconomic areas. In their data analysis, Veitch and colleagues also found no significant associations between children’s use of parks/playgrounds and other open spaces and the various distance and independent mobility measures, which suggests that factors other than distance and independent mobility influence children’s use of these places. While this study may be limited due to its reliance on self-report and the fact that children in low socioeconomic areas were located in the outer suburbs, it provides an important contribution to our understanding of children’s use of their local neighborhood for active free play.

Author Affiliation: The authors are with Deakin University in Australia.

Veitch, J., Salmon, J., & Ball, K. (2008). Children’s active free play in local neighborhoods: a behavioral mapping study. Health Education Research, 23(5), 870-879. This study may be available in a library near you or can be purchased online through the publisher at: http://her.oxfordjournals.org/

Being able to bike/walk to community recreation sites is an important determinant of how frequently they are used

Grow and colleagues investigated children and adolescents’ active use of 12 different types of community recreation sites; the relationships between proximity, walking/biking, and use of recreation sites; and relationships between neighborhood characteristics and whether children bike/walk to recreation sites. Researchers surveyed 89 parents of five- to ten-year-old children and 124 eleven- to eighteen-year-old adolescents, along with their parents, from three U.S. cities. In analyzing the data, Grow and colleagues found that the mean number of recreation sites children were reported to use at least every
other week was 4.9, while adolescents reported using a mean of 3.6 sites at least every other week. Parents reported that children most commonly used swimming pools, small public parks, and playgrounds, while adolescents reported most commonly using play fields/courts, indoor recreation facilities, and swimming pools. In examining whether proximity to sites was related to their frequency of use, Grow and colleagues found that living within a 10-minute walk of large public parks and public open space increased the likelihood that children and adolescents used these sites. In addition, while specific results varied by age, Grow and colleagues found that walking/biking to a recreation site was significantly related to the use of a number of sites, and in most cases was more important than the proximity of the site. Finally, in examining the relationship between neighborhood factors and active transport to recreation sites, researchers found that perceived traffic safety, pedestrian infrastructure, and crime threat were the most important determinants in whether adolescents biked/walked to a site. While this study may be limited due to its cross-sectional design and reliance on proxy and self-report, it highlights the importance of creating communities and policies that support children and adolescent’s ability to bike/walk to recreation sites.

Author Affiliation: Grow and Saelens are with the University of Washington. Kerr and Sallis are with San Diego State University. Durant is with the University of Alabama. Norman is with the University of California San Diego.

Grow, H. M., Saelens, B. E., Kerr, J., Durant, N. H., Norman, G. J., & Sallis, J. F. (2008). Where are youth active? roles of proximity, active transport, and built environment. Medicine and Science in Sports and Exercise, 40(12), 2071-2079. This study may be available in a library near you or can be purchased online through the publisher at: http://journals.lww.com/acsm-msse/pages/default.aspx

Certain neighborhood features influence parents’ perceptions of safety and children’s outdoor play
Handy and colleagues investigated relationships between the built and social environments of neighborhoods and children’s outdoor play using both a cross-sectional and quasi-longitudinal approach. Data for this study came from surveys completed by a random sample of nearly 600 households with children under the age of 16 who had either recently moved or not recently moved. Participants lived in one of eight neighborhoods in Northern California. Importantly, Handy and colleagues examined the effect of neighborhood characteristics on children’s outdoor play while controlling for neighborhood preferences. In analyzing the data, researchers found that cul-de-sacs for 6- to 12-year-old children, larger front yards, lower crime, and more interaction among neighbors were characteristics that significantly and positively impacted children’s outdoor play after controlling for socio-demographic characteristics and neighborhood preferences. Handy and colleagues also found that the built environment variables identified as significant (cul-de-sacs and larger front yards) were related to parents’ perceptions of safety. While this study may be limited due to its measure of outdoor play and reliance on parental report, it provides an important contribution to the literature and strengthens support for a causal relationship between the neighborhood environment and children’s outdoor play.

Author Affiliation: Handy and Mokhtarian are with the University of California Davis. Cao is with the University of Minnesota.
Handy, S., Cao, X., & Mokhtarian, P. (2008). Neighborhood design and children's outdoor play: evidence from Northern California. *Children, Youth and Environments, 18*(2), 160-179. This article is available online at: [http://www.colorado.edu/journals/cye/index_issues.htm](http://www.colorado.edu/journals/cye/index_issues.htm).

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**Children’s independent mobility influences their outdoor activity**

Wen and colleagues examined the amount of time children play outside after school and the relationship between outdoor play and children’s independent mobility. As part of this study, nearly 1400 ten- to twelve-year-old children from schools in Sydney, Australia completed a five-day diary about their time spent playing outdoors and engaged in screen time (watching television/video or playing computer games). In addition, children answered a question about their independent mobility and parents provided family and demographic information. In analyzing the survey data, Wen and colleagues found that 37% of children reported spending less than 30 minutes a day playing outdoors after school, 43% reported spending more than 2 hours a day engaged in screen time, and 48% reported being allowed to mostly walk on their own where they live. With regard to these measures, researchers found some gender differences. For example, significantly more boys than girls spent 2 or more hours a day playing outdoors and engaged in screen time. In addition, boys were significantly more likely to have greater independent mobility as compared to girls. In examining the relationship between outdoor play and children’s independent mobility, Wen and colleagues found a significant association between the two factors after adjusting for a number of other factors. Specifically, researchers found that children who reported being allowed to walk on their own sometimes or mostly were 1.74 and 2.56 times more likely to spend more than 30 minutes a day outdoors after school as compared to children who were never allowed to walk on their own near home. The researchers also found that children of parents who reported their neighborhood as being safe, reported being employed, and reported having an English-speaking home were more likely to have children that reported spending more time outdoors. While this study is cross-sectional in nature and relies on self-reported data, it provides important information from a relatively large sample concerning the role of independent mobility in children’s time spent outdoors.

Author Affiliation: Wen, Kite, and Rissel are with the Sydney West Area Health Service in Australia. Merom is with the University of Sydney in Australia.

**Children’s independent mobility is significantly related to their weekday physical activity levels**

Children’s ability to use their neighborhood unaccompanied by an adult is referred to as their “independent mobility.” Page and colleagues examined whether children’s independent mobility is related to their physical activity. To investigate this relationship, researchers had over 1300 ten- to eleven-year-old children from 23 primary schools in the United Kingdom complete a questionnaire about their neighborhood activities and wear an accelerometer for one week to measure their physical activity. In analyzing the study data, Page and colleagues identified two types of independent mobility: 1) local independent mobility, which included places close to children’s homes and 2) area independent mobility, which included places further from children’s homes. With regard to gender, independent mobility, and physical activity, researchers found that boys had significantly greater levels of local and area independent mobility and weekday and weekend physical activity compared to girls, whereas girls had significantly higher levels of body mass index (BMI) and pubertal status than boys. In terms of types of independent mobility, Page and colleagues found that both girls and boys had higher levels of local independent mobility as compared to area independent mobility. When examining the relationship between independent mobility and physical activity, researchers found that local and area independent mobility were significantly and positively related to physical activity levels for both boys and girls on weekdays—that is children with higher scores for local and area independent mobility tended to be more physically active on the weekdays. On the weekends, however, local independent mobility was the only significant predictor of physical activity levels in girls. While unclear, researchers speculate that on the weekends children may spend more time under parental supervision. Importantly, researchers controlled for a number of other variables in their analyses, including BMI, minutes of daylight, and socioeconomic status. While this study may be limited by its reliance on self-report of independent mobility and its cross-sectional design, it provides important insight into the relationship between independent mobility and physical activity in 10- to 11-year-old children.

Author Affiliation: The authors are with the University of Bristol in the UK.


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**Very few children walk to school and distance is the primary barrier**

Beck and Greenspan documented children’s usual mode of travel to school and reasons why children do not walk to school. To investigate this topic, researchers used data from a nationally representative telephone survey where over 2,000 parents answered questions about the school travel behavior of their 5- to 15-year-old child. In analyzing the data, Beck and Greenspan found that about 46% of children traveled to school via car, 40% via school bus, and 14% via walking. Children’s usual travel mode varied by age group, income and region of the country. For example, 5- to 11-year-old children were more likely to travel to school via car than 12- to 14-year-old children and children in the Northeast and West were more likely to walk to school than children in the South. In addition, researchers found that about 70% of parents identified distance...
as the primary barrier to their child walking to school, while about 9% identified traffic danger. While the study may be limited due to its emphasis on self-report, it provides important information concerning barriers to children walking to school, which could help inform policies and targeted interventions.

Author Affiliation: The authors are with the National Center for Injury Prevention and Control in Georgia.

Beck, L. F., & Greenspan, A. I. (2008). Why don’t more children walk to school? Journal of Safety Research, 39(5), 449-452. This study may be available in a library near you or can be purchased online through the publisher at: http://www.elsevier.com/wps/find/journaldescription.cws_home/679/description#description

Sociodemographic and physical environment factors influence children’s active travel between home and school

Larsen and colleagues investigated relationships between children’s mode of travel to and from school and various social and physical environment factors among 11- to 13-year-old students from a diversity of schools in London, Ontario, Canada. As part of this study, over 600 students, living within 1 mile of their school, completed a survey about their travel behavior and neighborhood. In addition, researchers used a Geographic Information System to identify participants’ home and school neighborhoods and used various databases to calculate specific sociodemographic and physical environment characteristics (e.g., presence of street trees, intersection density, and dwelling density). In analyzing the study data, Larsen and colleagues found that 62% of students actively traveled from home to school, while 72% of students actively traveled from school to home. Researchers found that students were more likely to actively travel to or from school if they lived closer to school, were male, their neighborhood had a higher land use mix, and there were more street trees. For example, boys were about 1.5 times more likely to actively travel to/from school than girls. Additional research is needed to understand why some of these factors influence children’s travel behavior. While this study may be limited due to its reliance on self-report and use of neighborhood-level information, it improves our understanding of the social and physical factors influencing children’s travel to and from school and highlights the importance of school location.

Author Affiliation: Larsten and Irwin are with the University of Western Ontario in Canada. Gilliland is with the Children’s Health Research Institute and University of Western Ontario in Canada. Hess is with the University of Toronto in Canada. He is with the University of Texas.

Larsen, K., Gilliland, J., Hess, P., Tucker, P., Irwin, J., & He, M. Z. (2009). The influence of the physical environment and sociodemographic characteristics on children’s mode of travel to and from school. American Journal of Public Health, 99(3), 520-526. This study may be available in a library near you or can be purchased online through the publisher at: http://www.ajph.org/

Technology may help engage children in outdoor activities

Chavez conducted an exploratory study to investigate the role of technology in supporting or enhancing children’s outdoor experiences. As part of Youth Day in Los Angeles, CA 38 six- to seventeen-year-old children participated in four activities—two
were technology-based (a camera safari and geocaching for treasure) and two were not technology-based (nature rubbings and a nature scavenger hunt). All children participated in each of the four activities and voted on how much they liked each activity. In addition, adult observers and trained facilitators provided feedback on children’s participation in each activity. In analyzing the data, Chavez found that all activities received a majority of positive votes, but that technology dependent activities received a higher percentage of positive votes as compared to non-technology dependent activities. While there are a number of factors that could have influenced these findings, such as participant age and the specific activities selected, this study suggests that technology may help engage children in outdoor activities.

Author Affiliation: Chavez is with the USDA Forest Service.

Chavez, D. J. (2009). Youth day in Los Angeles: evaluating the role in technology in children's nature activities. Children, Youth and Environments, 19(1), 102-124. This article is available online at: http://www.colorado.edu/journals/cye/index_issues.htm.

Making time to play is important to children and parents

Playday, an annual celebration of children’s right to play, commissioned a national opinion poll, a series of focus groups with children, and a literature review of existing research concerning the amount of time dedicated to play. These three components are summarized below.

- ICM Research conducted telephone interviews with a random sample of over 1,000 adults and 1,000 seven- to fourteen-year-old children across the United Kingdom. Among their results, ICM Research found: 1) 72% of parents reported that they would like more time to play with their children; 2) 50% of parents reported that there are not enough places for their children to play safely without adult supervision; 3) over 50% of parents reported that work or other commitments keep them from playing with their children; 4) both parents and children reported that not having enough time to play makes children feel bored, unhappy, and miss their friends; 5) 34% of children reported that homework often limits their amount of time for play; and 6) 37% of children reported that they would rather play with friends than participate in organized activities.

- Inspire Consultancy Limited conducted focus groups with 71 seven- to fourteen-year-old children in England, Scotland, Wales, and Northern Ireland to better understand their time for play. Some of the key findings were: 1) friends to play with, time to play, and unstructured play were the most important characteristics children reported for an enjoyable play experience; 2) children reported limited amounts of time during the week for play and that weekends allowed more freedom for play; 3) about 50% of children reported wanting more time to play, while the other half reported having enough time for play; 4) older children were less content than younger children with the quality of their play experiences; 5) children reported wanting balance between structured activities and unstructured play; and 6) many children reported that their favorite time to play was at school because they could play with friends.

- Gleave reviews the literature related to the importance of play to children and factors that restrict children’s ability to play. Some of the topics he reviews include: 1) the benefits of play to child health and development; 2) the amount of time children play;
3) the amount of time children engage in structured activities; 4) children’s unstructured play; and 5) differences in children’s play based on age, gender, ethnicity, and other sociodemographic factors.

These reports are available online at:

Mothers and child development professionals have different beliefs about play

Play is important to children’s healthy development. Despite the critical role that caregivers provide in children’s everyday lives, little is known about parents’ beliefs about play and how these beliefs might influence children’s play behavior. In this article, Fisher and colleagues discuss two studies they conducted to investigate play beliefs and their relationship to children’s learning and behavior among U.S. mothers and child development professionals. Over 1100 mothers with 0- to 5-year-old children and almost 100 child development professionals participated in an internet survey about play. In analyzing study data, Fisher and colleagues found that mothers conceptualized play as being either unstructured (activities generally involving imagination or creativity) or structured (activities generally involving specific goals) and that there were 3 general groups of mothers that varied in their play beliefs: 1) “traditional” mothers (44% of mothers) rated unstructured activities as highly playful and structured activities as less playful, 2) “all play” mothers (45% of mothers) rated unstructured and structured activities as highly playful, and 3) “uncertain” mothers (12% of mothers), while being highly variable, tended to rate unstructured activities as being somewhat playful and structured activities as being neither playful nor unplayful. Researchers also found that while, overall, mothers rated structured play as having more learning value than unstructured play, mothers differed in the learning value they associated with different play behaviors based on their play beliefs. For example, researchers found that “all play” mothers placed a significantly higher academic value on unstructured play as compared to “traditional” and “uncertain” mothers. In addition, Fisher and colleagues found that the frequency with which children were reported to engage in unstructured and structured play varied according to their mother’s play beliefs. For example, researchers found that children of “all play” mothers were reported to engage in significantly more unstructured play than children of “uncertain” and “traditional” mothers. When comparing play beliefs among child development professionals and mothers, researchers found that while both mothers and experts viewed play as essential to children’s future academic learning, the two groups differed with regard to their specific play beliefs: in contrast to mothers, experts rated unstructured activities as being more playful and of greater academic learning value than structured activities. While the findings of this study may be limited due to the researchers’ reliance on volunteers and self-report, it provides important insight into the different meanings of play and how future efforts may best address balancing unstructured and structured play in children’s lives.

Author Affiliation: Fisher and Hirsh-Pasek are with Temple University. Golinkoff is with the University of Delaware. Gryfe is with Fisher-Price Inc.

Focus: Outdoor Spaces

The quality and quantity of children’s outdoor spaces may influence their experiences and contact with nature. These articles examine topics related to children’s outdoor spaces.

Positive and negative features coexist in children’s preferred outdoor places

Castonguay and Jutras examined 7- to 12-year-old children’s liked, favorite, and disliked outdoor places in their neighborhood. Children participating in this study lived in a poor neighborhood in Montreal, Quebec, Canada. The 28 participating children photographed outdoor places in their neighborhood that they liked to go and researchers individually interviewed each child about their photographs, as well as their favorite place and places they disliked. In analyzing the content of the interviews and photographs, Castonguay and Jutras found that parks and playgrounds were both children’s most liked and disliked places, while the greatest percentage of children identified spaces near an acquaintance’s home as their favorite place. In examining variation in children’s place preferences, researchers found that preferences did not vary significantly with regard to family structure, income, or length of residence, however, older children were more likely to identify parks and playgrounds as liked places, whereas younger children were more likely to identify spaces near an acquaintance’s home as liked places. With regard to favorite versus liked places, Castonguay and Jutras found that children attributed a greater number of positive characteristics and activities that they could engage in to their favorite places. In addition, researchers found that many children talked about natural elements in terms of their liked places and safety threats in terms of disliked places. While this study may be limited due to its small sample size and reliance on volunteers, it provides valuable insight into how positive and negative features of places can coexist and the importance of providing safe play opportunities.

Author Affiliation: The authors are with the Université du Québec à Montréal in Canada

Castonguay, G., & Jutras, S. (2009). Children's appreciation of outdoor places in a poor neighborhood. *Journal of Environmental Psychology, 29*(1), 101-109. This study may be available in a library near you or can be purchased online through the publisher at: http://www.elsevier.com/wps/find/journaldescription.cws_home/622872/description#description

Adventure playgrounds provide important opportunities for outdoor, unstructured play

In this article, Staempfli provides an overview of adventure playgrounds and their potential to support children’s healthy development. She argues that adventure playgrounds are an important, but not often considered, play alternative. Staempfli provides historical background on the establishment of adventure playgrounds and the diversity of adventure playgrounds that currently exist, primarily in Europe. She also highlights the lack of attention that adventure playgrounds have received in North
America and Canada, which is thought to primarily be due to concerns about safety and cultural ideas about risk. Staempfli provides an overview of the structure of adventure playgrounds and their use of trained playworkers to mediate play and provide supervision. She also reviews current knowledge about the developmental benefits, both at a personal and community level, of adventure playgrounds, as well as information about accidents and injuries. Finally, in concluding this article, Staempfli outlines areas of future investigation, as well as the need to build awareness about the importance of adventure play.

Author Affiliation: Staempfli is with the University of Waterloo in Canada.

Staempfli, M. B. (2009). Reintroducing adventure into children's outdoor play environments. Environment and Behavior, 41(2), 268-280. This study may be available in a library near you or can be purchased online through the publisher at: http://eab.sagepub.com/

The surrounding landscape can influence children's playground experiences
Children's perspectives on public playgrounds are rarely evaluated. In this study, Jansson investigated children's perspectives on public playgrounds in two Swedish communities with different surrounding landscapes—one forested and one open land. She interviewed 141 six- to eleven-year-old children in a series of groups. Jansson asked children about the playgrounds they used and their opinions about these playgrounds. In analyzing the study data, she reported many findings. For example, Jansson found that children expected playgrounds to be “fun” and to provide “things to do.” She also found that playgrounds were about activity and what specific things a child could do and that the social aspects of playground play were important, such as being with a friend. In addition, Jansson found that playgrounds that lacked challenges or that did not provide a range of opportunities for a diversity of ages frustrated children. With regard to playground surroundings, she found that children appreciated having access to natural surroundings, that they often viewed these features as part of the playground, and that children played in a larger space than the designated playground when it was surrounded by vegetation. While this study may be limited due to its small sample size, it provides valuable insight into the importance of considering children’s playgrounds within the context of the larger landscape and social environment.

Author Affiliation: Jansson is with the Swedish University of Agricultural Sciences in Sweden.


Public open spaces in lower socioeconomic neighborhoods have fewer amenities
Crawford and colleagues investigated relationships between neighborhood socioeconomic status and park features likely to promote children’s physical activity (e.g., athletic tracks, walking paths, water features, etc.). Researchers collected data for 540 families of 5- to 6- and 10- to 12-year-old children in Melbourne, Australia from diverse socioeconomic areas. Crawford and colleagues geo-coded participant addresses, identifying all public open spaces within an 800 meter radius of each
participant’s home. Researchers also created a tool and visited each public open space to assess its features. In analyzing the data, Crawford and colleagues found that while low and high socioeconomic neighborhoods had similar numbers of playgrounds and recreation facilities, public open spaces in the highest socioeconomic neighborhoods were significantly more likely to have more amenities as compared to spaces in lower socioeconomic neighborhoods. While additional research is needed to more fully understand the relationship between the quantity and quality of public open spaces and children’s physical activity, this study suggests that children of lower socioeconomic position may have fewer opportunities to engage in physical activity.

Author Affiliation: Crawford, Timperio, Ball, Hume, Roberts, Andrianopoulos, and Salmon are with Deakin University in Australia. Giles-Corti is with the University of Western Australia.

Crawford, D., Timperio, A., Giles-Corti, B., Ball, K., Hume, C., Roberts, R., et al. (2008). Do features of public open spaces vary according to neighbourhood socio-economic status? Health & Place, 14(4), 889-893. This study may be available in a library near you or can be purchased online through the publisher at: http://www.elsevier.com/wps/find/journaldescription.cws_home/30519/description#description

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**Early childhood educators prefer vegetated outdoor play spaces**

The quality of children’s outdoor environments can influence their health and development. In this study, Herrington investigated early childhood educators’ opinions on their center’s outdoor play spaces. She conducted focus group interviews with 78 educators at a diversity of childcare centers for 3- to 5-year-olds in Vancouver, Canada and evaluated the design of each outdoor play space. In analyzing the data in terms of educators’ positive and negative comments about center location, layout, and plant material, Herrington found that outdoor play spaces with plants had significantly more positive responses from educators than spaces without plants. She also found that educators at centers with plants commented more positively on seasonal changes than educators at centers without plants. In considering the socioeconomic status of the centers, Herrington found that the greatest need for vegetation was in mixed-income and economically stressed neighborhoods. Overall, she found that play spaces in economically stressed neighborhoods received some of the most negative comments from educators. With regard to desired changes at their centers, Herrington found that 79% of educators wanted more sensory stimuli for children, such as plants or water; 64% wanted more space; 57% wanted more challenging equipment; and 50% wanted less concrete. In addition, all the educators at centers with bark mulch indicated that they wanted it removed as it caused splinters. While this study may be limited due to its reliance on volunteers, it provides valuable insight into the opinions of early childhood educators and the importance of vegetation in their positive evaluation of outdoor play spaces.

Author Affiliation: Herrington is with the University of British Columbia.

Herrington, S. (2008). Perspectives from the ground: early childhood educators’ perceptions of outdoor play spaces at child care centers. Children, Youth and Environments, 18(2), 65-87. This article is available online at: http://www.colorado.edu/journals/cye/index_issues.htm
Focus: Physical Activity & Weight
Nature may encourage and support children’s physical activity and help them maintain a healthy weight. While not directly related to children’s experience of nature, these studies highlight the current status of children’s physical activity and weight.

Canadian children receive an “F” in physical activity
For the past five years, the organization Active Healthy Kids Canada has created an annual report card on the many factors impacting children’s physical activity in Canada. In developing their report card, the organization analyzes current data and literature related to physical activity. With regard to physical activity levels, Canadian children were given an “F” this year as 87% of children did not meet Canada’s physical activity guidelines of 90 minutes of physical activity a day, however, the proportion of children meeting the guidelines increased from 9% in 2005/2006 to 13% in 2007/2008. In their report, the organization also reviews research concerning children’s screen time behavior, organized sport and physical activity participation, active play, and active transportation, as well as disparities among children with regard to physical activity. In addition, the organization discusses research related to influential factors, including schools, family and peers, the community and built environment, and health policy. This report provides a comprehensive and valuable look at the many issues impacting children’s physical activity levels.


An update on children’s physical activity and sedentary behavior
Keeton and Kennedy review recent research related to physical activity and sedentary behavior among children. The authors review current information about childhood overweight and obesity; the relationship between active transportation to school, access to recreational opportunities, and physical activity; the relationship between screen time, physical activity, and obesity; and physical activity among children with disabilities. Among the findings they discuss, Keeton and Kennedy highlight several recent studies that have found that children who actively commute to school tend to be more physically active. In addition, while more research is needed to understand some conflicting results, the authors discuss research that has found a relationship between children’s proximity to recreation sites and site use, and proximity to playgrounds and children’s weight. Keeton and Kennedy discuss the importance of safety and how it is a common barrier identified in studies to date. The authors also highlight inconsistent findings with regard to the relationship between physical activity, screen time, and obesity and emerging studies in the area of active gaming. Finally, Keeton and Kennedy discuss the special needs of children with disabilities and the importance of removing environmental barriers to support their ability to engage in physical activity. The researchers conclude their review by offering a set of tips for pediatric providers to help them address the topic of physical activity with families.
Many young children do not meet health recommendations in terms of their physical activity and screen time behavior

To help prevent childhood obesity, health agencies currently recommend that children engage in no more than 2 hours of screen time per day and are active for at least 60 minutes per day. In this study, Anderson and colleagues estimated the percentage of children in the U.S. that have low levels of active play, high levels of screen time, and both low levels of active play and high levels of screen time. The authors also examined whether these behaviors were associated with children’s age, gender, race/ethnicity, and weight. Anderson and colleagues defined “low levels of active play” as a child who plays less than 7 times per week in a way that makes him/her sweat and breathe hard and “high screen time” as a child who watches television or videos or uses a computer for more than 2 hours per day. The authors analyzed data for nearly 3,000 four- to eleven-year-old children that were collected during a large, nationally representative study from 2001 to 2004 (the National Health and Nutrition Examination Survey or NHANES). As part of this survey, each child’s weight and height was measured and an adult (most often a parent) responded to interview questions about their child’s active play and screen time behaviors and provided demographic information. In analyzing the data, Anderson and colleagues found that about 37% of all children had low levels of active play, 65% had high levels of screen time, and about 26% had both low levels of active play and high levels of screen time. Among their many results, the authors also found that children who were older in age, female, non-Hispanic black, and had a high body mass index were more likely to have both low active play and high screen time levels. Importantly, Anderson and colleagues consider their estimates of children with low levels of active play and high levels of screen time to be conservative. While this study is cross-sectional and therefore no causal associations can be made, it provides important information regarding children’s active play and screen time behaviors that can help inform health policies and programs.

Author Affiliation: Anderson is with The Ohio State University of Public Health. Economos and Must are with Tufts University.

Anderson, S. E., Economos, C. D., & Must, A. (2008). Active play and screen time in US children aged 4 to 11 years in relation to sociodemographic and weight status characteristics: a nationally representative cross-sectional analysis. BMC Public Health, 8, 13. This study may be available in a library near you or can be purchased online through the publisher at: http://www.biomedcentral.com/bmcpublichealth/

Many preschoolers do not achieve recommended physical activity levels

Tucker reviews 39 studies published between 1986 and 2007 on the physical activity levels of preschool-aged children. She reviews the literature in terms of guidelines put forth by the National Association for Sport and Physical Education, which recommends...
that preschool children engage in at least 60 minutes of physical activity and up to several hours of unstructured play each day. In examining the literature, Tucker found that almost half of preschool-aged children do not engage in 60 minutes of physical activity a day. Importantly, she notes that this is a conservative estimate as it does not include information on unstructured play. In addition, Tucker found that male children were more active than female children. In concluding her review, she identifies the need for interventions that support physical activity, especially in females, and more uniform assessment and reporting methods to facilitate understanding and comparison across studies. Tucker also highlights the important role of early childhood educators, parents, and teachers in promoting children’s healthy physical activity levels.

Author Affiliation: Tucker is with the University of Western Ontario in Canada.

Tucker, P. (2008). The physical activity levels of preschool-aged children: a systematic review. Early Childhood Research Quarterly, 23(4), 547-558. This study may be available in a library near you or can be purchased online through the publisher at: http://www.elsevier.com/wps/find/journaldescription.cws_home/620184/description

**Physical activity declines between the ages of 3 and 4 to 5 years**

We currently know very little about how children’s physical activity changes over time. In this study, Taylor and colleagues followed 3- to 5-year-old children to investigate patterns of physical activity and inactivity. Over 200 children from Dunedin, New Zealand participated in this study. Each year researchers measured children’s height and weight, children and their parents wore accelerometers to assess physical activity, and parents completed a questionnaire regarding their children’s physical activity and inactivity. In analyzing the data, Taylor and colleagues found that children spent about 90 minutes a day engaged in screen time and an additional 90 minutes a day engaged in other sedentary activities. With regard to physical activity levels, the researchers found that children’s physical activity was significantly reduced at 4 and 5 years of age as compared to 3 years of age. For example, children’s time in moderate to vigorous activity dropped nearly 50% between the ages of 3 and 4. In investigating factors that might influence children’s physical activity, Taylor and colleagues found that day of the week, season, gender, hours of childcare, and birth order were not significant influences, but that the father’s activity level had a small but significant influence on children’s physical activity. This study is one of the few longitudinal studies with a fairly large sample size that has been conducted to date and provides an important contribution to our understanding of activity in 3- to 5-year-old children.

Author Affiliation: The authors are with the University of Otago in New Zealand.


**Parents and preschool staff weigh in on factors influencing children’s physical activity**
Dwyer and colleagues investigated parent and preschool staff attitudes and knowledge about factors that influence physical activity and television viewing behavior among preschool-age children. To examine these issues, researchers conducted 9 focus groups with 39 participants in Sydney, Australia from specific sociocultural groups that are at an increased risk for the development of overweight and obesity (i.e., children from lower socioeconomic and Middle-Eastern and Chinese communities). In analyzing the themes from the focus group data, Dwyer and colleagues reported many interesting findings. For example, researchers found that parents and preschool staff recognized the difference in physical activity behavior between young children, older children, and adults and suggested that the term “intensity” was not applicable to young children’s physical activity behavior. Parents and staff identified physical, mental, and social benefits of physical activity, however, were not familiar with physical activity guidelines. Parents and preschool staff also reported a number of facilitators and barriers to children’s physical activity. Key facilitators of physical activity included a child’s preference for being active, positive family or peer modeling, access to safe play areas and play opportunities (e.g., organized programs), and a sense of social connectedness (e.g., neighborhood friends). Key barriers to physical activity included concerns about safety at both a personal and community level, time and financial constraints, competing values (e.g., for educational achievement), and safety regulations with regard to preschool environment design. In addition, Dwyer and colleagues found that many parents were concerned with the effects of excessive TV viewing and thus consciously moderated their children’s viewing behavior. Many parents believed that young children were naturally active and societal influences, such as television, negatively influenced this natural tendency. Preschool staff were also concerned about television viewing and over-scheduling and believed that they negatively influenced children’s ability to engage in creative play. While this study may be limited due to its reliance on volunteers, it provides a valuable contribution to the literature because it examines the influences of physical activity in young children using a qualitative approach.

Author Affiliation: Dwyer, Hardy, and Baur are with the University of Sydney in Australia. Higgs is with Charles Sturt University in Australia.


**Many children are obese or overweight**

In this report, Levi and colleagues examine obesity trends in the United States and factors related to these trends. Data on childhood obesity were obtained from the 2007 National Survey of Children’s Health, a national telephone survey that in 2007-2008 surveyed over 90,000 parents of 0- to 18-year-old children. With regard to childhood obesity trends, Levi and colleagues report that the percentage of obese and overweight 10- to 17-year-old children (above the 85th percentile for body mass index or BMI) is 30% or greater in 30 states. Eight of the ten states with the highest rates of obese and overweight children are located in the South, while six of the states with the lowest rates of obese and overweight children are in the West. The authors also discuss the findings from a large 2007 survey of low-income 2- to 5-year-old children, which found that...
almost 15% of surveyed children were obese (equal to or greater than the 95\textsuperscript{th} percentile for BMI) as compared with 12.4\% of U.S children overall in this age group. In their report, Levi and colleagues discuss recent research showing that children gain weight two to three times faster during the summer as compared to during the school year. The authors also summarize and review numerous factors influencing children’s nutrition and physical activity, such as food choices, marketing and advertising, community design, and time constraints, and summarize key findings related to the health impacts of obesity. In addition, Levi and colleagues review guidelines for physical activity and summarize recent trends. In the final sections of this report, Levi and colleagues examine federal and state policies and programs designed to address obesity, including snack taxes, physical education, and local farm initiatives. In addition, the authors provide recommendations to combat obesity.

Author Affiliation: The authors are with Trust for America’s Health.

Levi, J., Vinter, S., Richardson, L., St.Laurent, R., & Segal, L. (2009). F as in fat: how obesity policies are failing in America. Trust for America’s Health. This report is available online at: http://healthyamericans.org/reports/obesity2009/

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**Focus: Environmental Knowledge & Behavior**

Children’s exposure to nature may influence their environmental knowledge and behavior as children, as well as throughout their lives. These articles examine youth’s biodiversity knowledge and changes in environmental concerns.

**Adolescents’ environmental concerns have generally declined since the early 1990s**

Wray-Lake and colleagues describe and analyze trends in environmental attitudes, beliefs, and behaviors of nearly 10,000 adolescents from 1976 to 2005. Researchers examined data from the Monitoring the Future study, a survey that has been conducted annually among a nationally representative sample of U.S. high school seniors. As part of this survey, a wide range of information is gathered from adolescents, including information about their conservation behaviors; attitudes toward consumer, government, and personal responsibility for the environment; and resource scarcity. In examining trends in adolescents’ environmental concerns over the past three decades, overall, the researchers found increases during the early 1990s and declines over the remainder of the last three decades. For example, researchers found steep declines in adolescents’ willingness to engage in conservation behaviors, such as reducing their electricity or heat usage or driving less. In addition, Wray-Lake and colleagues found that adolescents were more likely to support consumer and government responsibility to protect the environment than to take personal action. The researchers also conducted some preliminary explorations of associations between different trends, as well as materialistic values and technological beliefs. Among their findings, Wray-Lake and colleagues reported parallel trends for resource scarcity and conservation behavior and negative associations between materialism and personal environmental responsibility and conservation. The researchers discuss observed trends as they relate to adult opinions and specific historic events and time periods, such as the 1970s energy crisis.
and different presidential administrations. Wray-Lake and colleagues highlight the importance of examining and understanding young people’s environmental concerns and suggest areas for future research. While this study may be limited due to the specific conservation behaviors investigated, it is unique and provides a valuable contribution to the literature in that it examines adolescents’ environmental concerns among a nationally representative sample of youth over time.

Author Affiliation: The authors are with The Pennsylvania State University.

Wray-Lake, L., Flanagan, C. A., & Osgood, D. W. (2009). Examining trends in adolescent environmental attitudes, beliefs, and behaviors across three decades. Environment and Behavior (May 5). This study may be available in a library near you or can be purchased online through the publisher at: http://eab.sagepub.com/

Children and adults in Switzerland know little about biodiversity

Lindemann-Matthies and Bose interviewed and surveyed over 350 potentially more “biodiversity-knowledgeable” youth and adults in Switzerland to better understand people’s knowledge of biodiversity. In analyzing the study data, researchers found that 60% of study participants had never heard the term biodiversity. With regard to grammar school students, however, the percentage was higher with 77% of students reporting to have never heard about biodiversity. Lindemann-Matthies and Bose found that for those participants who had heard the term biodiversity, the media, rather than school education, was identified as a provider of biodiversity information. In addition, researchers found that participants highly overestimated plant species richness in Switzerland and worldwide. Importantly, Lindemann-Matthies and Bose found that most participants were interested in biodiversity issues and thought that it was important. While this study had a relatively small sample size, it demonstrates that despite the increased attention biodiversity has received from the environmental research and policy communities, many people in Switzerland are still unfamiliar with biodiversity. To enhance biodiversity education and conservation, Lindemann-Matthies and Bose suggest the need to reconnect people to nature, promote more in-depth knowledge of biodiversity, and encourage people to take environmentally-friendly actions.

Author Affiliation: The authors are with the University of Zurich in Switzerland.

Lindemann-Matthies, P., & Bose, E. (2008). How many species are there? public understanding and awareness of biodiversity in Switzerland. Human Ecology, 36(5), 731-742. This study may be available in a library near you or can be purchased online through the publisher at: www.krepublishers.com/...Journals/.../JHE-00-0-000-000-1990-1-Cover.htm

Focus: Other

This article highlights other important topics related to children’s experience of nature.

Research is needed to understand whether and why inequalities exist in terms of children’s exposure to toxic pollutants, nature, and green space
In recent years, numerous studies have examined race- and class-based environmental inequality in terms of adult exposure to toxic pollutants. Strife and Downey review research that has examined: 1) inequality in children’s exposure to industrial environmental hazards, 2) children’s exposure to nature as it relates to their health and the health of the planet, and 3) research related to inequality in children’s exposure to nature. The authors conclude that very little research has been conducted to determine whether and why inequalities exist in terms of children’s exposure to toxic pollutants and nature. Strife and Downey highlight the importance of improving our knowledge in these areas, suggest expanding research efforts, and provide ideas on how additional research could be implemented.

Author Affiliation: The authors are with the University of Colorado.

Strife, S., & Downey, L. (2009). Childhood development and access to nature: a new direction for environmental inequality research. Organization & Environment, 22(1), 99-122. This study may be available in a library near you or can be purchased online through the publisher at: http://www.coba.usf.edu/jermier/journal.htm