



Research and Studies Volume Five November 2011

Annotated Bibliography
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This annotated bibliography updates research compiled in volumes one through four of the Children & Nature Network (C&NN) research resources (www.childrenandnature.org/research), with an emphasis on research published in 2009-2011 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 lead/corresponding author affiliation, 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.

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Section 1: Benefits to children from contact with nature

This section reviews research from 2009-2011 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.

Focus: Health benefits

These articles examine relationships between children's outdoor-related behavior and nature contact and their physical, mental, and social health and well-being.

Research Syntheses:

Physical activity and exposure to nature are important to good health

In this literature review, Pretty and colleagues examine the role of physical activity and nature contact on health and well-being, with a particular focus on children. The authors discuss the current state of physical inactivity, the positive health benefits of nature contact, and the potential role of green exercise (activity in the presence of nature) toward improving health and well-being. Pretty and colleagues review three stages of childhood and their differing needs, evidence regarding children's physical activity levels, and the benefits of children's exposure to nature. The authors discuss the impact of urban design and green space in terms of physical activity and various health outcomes, including cognitive health and learning, as well as the impact of nature-based interventions, such as care farms and wilderness therapy, for children with special needs. Based on their review, Pretty and colleagues propose two conceptual pathways—healthy and unhealthy—that shape our lives and life outcomes. On the healthy pathway, people are active, connected to people and society, engage with natural places, and eat healthy foods and as a result tend to live longer and have a better quality of life. On the unhealthy pathway, people are inactive, disconnected to people and society, do not engage with natural places, and eat unhealthy foods, and as a result die earlier and have a lower quality of life. In concluding their review, Pretty and colleagues make ten recommendations to improve people's well-being, including increasing children's outdoor free play and encouraging planners to incorporate access to green space.

Author Affiliation: Jules Pretty is with the University of Essex in the UK.

Pretty, J., Angus, C., Bain, M., Barton, J., Gladwell, V., Hine, R., et al. (2009). *Nature, childhood, health and life pathways*. University of Essex. This report is available online at:
<http://www.essex.ac.uk/ces/occasionalpapers/Nature%20Childhood%20and%20Health%20iCES%20Occ%20Paper%202009-2%20FINAL.pdf>



Being outdoors is important to our health

Godbey examines the health benefits of being outdoors, including the role these activities play in stress reduction. He also examines outdoor recreation as it relates to specific children's health issues, including obesity and attention-deficit hyperactivity disorder, and how spending time outdoors can benefit children with these health challenges. Godbey investigates children's connection with nature and the many variables that impact children's outdoor play. He discusses different approaches to measuring physical activity and participation in outdoor recreation, as well as recent trends in park visitation and outdoor activity participation. He also highlights numerous factors that impact participation in outdoor activities, including amount of leisure time, proximity to outdoor space, safety of parks, and park and playground design. Throughout the review, Godbey highlights specific research gaps that could help guide future efforts. He also discusses changing demographics as they relate to outdoor recreation and what these changes may mean in terms of successful policymaking.

Author Affiliation: Geoffrey Godbey is with Resources for the Future.

Godbey, G. (2009). *Outdoor Recreation, Health, and Wellness: Understanding and Enhancing the Relationship*. Washington DC: Resources for the Future. This report is available online at: <http://www.rff.org/documents/RFF-DP-09-21.pdf>

Green environments are essential to human health

In this report, Kuo reviews evidence of the benefits that nature contact provides to our health. Kuo begins by discussing the development of nature-human health research and how in the last decade research has become incredibly diverse and rigorous. As a result of the research that has been conducted to date, she concludes that green environments are essential to human health. In the bulk of the report, Kuo reviews evidence of the benefits that nature contact provides to our social, psychological, and physical health. In each major section, she discusses evidence from a sampling of relevant studies that are diverse and of high quality. For example, she reviews evidence that nature contact promotes healthier social behavior and lessens social dysfunction, helps alleviate stress, improves resilience, promotes optimal psychological functioning, improves recovery from physical trauma, and reduces mortality. Kuo discusses current ideas on how nature might promote human health, including the role of physical activity, immune functioning, and stress reduction. She also discusses a set of larger themes that have emerged from the literature, such as that green environments must be experienced to have positive health impacts and that nature contact can take many forms and occur at many different dosage levels. Kuo concludes her report by providing specific recommendations on how to increase people's nature contact and its associated health benefits by: 1) providing as much nature, in as many forms as possible; 2) bringing nature to people; and 3) bringing people to nature.

Author Affiliation: Frances Kuo is with the University of Illinois at Urbana-Champaign.



Kuo, F. E. (2010). *Parks and other green environments: essential components of a healthy human habitat*. National Recreation and Park Association. This report is available online at: [http://www.nrpa.org/uploadedFiles/Explore_Parks_and_Recreation/Research/Ming%20\(Kuo\)%20Reserach%20Paper-Final-150dpi.pdf](http://www.nrpa.org/uploadedFiles/Explore_Parks_and_Recreation/Research/Ming%20(Kuo)%20Reserach%20Paper-Final-150dpi.pdf)

Nature provides a variety of mental health and well-being benefits

Townsend and Weerasuriya review the literature on the relationship between nature and health and well-being, with a specific focus on mental health and well-being. To conduct their review, the authors examined peer-reviewed journal articles, grey literature, and books, with an emphasis on articles published in the last decade. Townsend and Weerasuriya provide a very thorough and detailed report covering a range of valuable topics. The authors begin by discussing major theories about why or how nature contact impacts human health and well-being, including the biophilia hypothesis and attention restoration theory. The authors then review physical, mental, and social health benefits associated with nature contact, including benefits for specific populations (e.g., children and the elderly). Townsend and Weerasuriya then move on to discuss the benefits of nature contact to mental health for the population in general, as well as specific populations (e.g., children, prisoners, and indigenous populations). The authors then review specific types of landscapes and their therapeutic mental health impacts, including local parks, forests and gardens, as well as different therapeutic approaches, including wilderness therapy and horticulture therapy. Townsend and Weerasuriya also discuss evidence concerning impacts to mental health from animal contact, ranging from contact with pets to therapeutic programs with dolphins. The authors highlight various dimensions of mental health that can be positively impacted by nature contact, including cognitive functioning and stress reduction, depression, and attention-deficit hyperactivity disorder. In the last sections of the report, the authors discuss additional aspects of the relationship between nature and mental health, including physical activity and social connectedness, the relationship between climate change and mental health, and the linkages between urban environments and mental health.

Author Affiliation: Mardie Townsend is with Deakin University in Australia.

Townsend, M., & Weerasuriya, R. (2010). *Beyond blue to green: The benefits of contact with nature for mental health and well-being*. Melbourne, Australia. This report is available online at: http://www.beyondblue.org.au/index.aspx?link_id=59.1284

Natural environments may provide added health benefits above and beyond human-made environments

In recent years, a number of studies have examined the role of natural environments in human health. In this article, Bowler and colleagues conducted a systematic review of research to determine whether there is an “added benefit” from activities in natural environments that goes above and beyond those in more human-made environments. Bowler and colleagues specifically focused on studies where there was a comparison of the same activity in natural and human-made environments so that the effect of the environment could be determined. The authors examined 25 studies that

included a variety of types of natural environments (e.g., public parks or university campuses) and outcome measures (e.g., emotions or attention/concentration). In analyzing the study results, Bowler and colleagues found that activities in a natural environment resulted in reduced negative emotions (e.g., anger, fatigue and sadness) as compared to similar activities in a human-made environment. The authors also found that activity in a natural environment may result in improved attention as compared to a human-made environment, however, the added benefit disappeared when pretest differences were taken into account. Bowler and colleagues did not find strong evidence of differences in terms of other physiological variables examined, such as blood pressure, however, there were not many studies in this area to examine. This article provides a valuable contribution toward our understanding of the benefits of nature to human health. In concluding their article, the authors discuss characteristics of the studies they examined and suggest areas of future research.

Author Affiliation: Andrew Pullin is with Bangor University in the UK.

Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, 10(1), 456. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.biomedcentral.com/bmcpublichealth/>

Outdoor skills education supports our health, learning, and lifestyle

Cottrell and Raadik-Cottrell review the benefits that outdoor skills education and wildlife-related outdoor education provide to our health, learning, and lifestyle. In addition, the authors review information concerning the relationship between outdoor skills education and fishing and hunting participation. In developing this report, Cottrell and Raadik-Cottrell reviewed over 100 relevant documents, including industry and non-governmental organization reports and academic peer-reviewed articles. In their review, the authors discuss evidence regarding the benefits of outdoor skills education, including improved interpersonal and intrapersonal skills; environmental awareness and stewardship ethics; physical, mental, and social health; and ability to learn and concentrate. With regard to hunting and fishing, Cottrell and Raadik-Cottrell discuss indicators of recruitment and retention in these outdoor activities, including early life experiences, mentorship, and structured programs that are culturally appropriate and more holistic/ecologically oriented. The authors highlight some successful outdoor skills programs and provide a series of recommendations to enhance different types of programs, such as understanding volunteer expectations and providing continuous and progressive outdoor education experiences. Cottrell and Raadik-Cottrell conclude their report with a list of recommendations for future research.

Author Affiliation: Stuart Cottrell is with Colorado State University and Cottrell and Associates Environmental Consulting.

Cottrell, S., & Raadik-Cottrell, J. (2010). *Benefits of outdoor skills to health, learning and lifestyle: A literature review*. Association of Fish & Wildlife Agencies' North American Conservation Education Strategy. This report is available online at:
http://outdoornebraska.ne.gov/Education/pdf/BenefitsofOutdoorSkills_WhitePaper_11-2010_Final%20with%20cover.pdf

Wilderness programs improve participants' health, behavior, and attitudes

The connection between natural landscapes and human health provides an important avenue to support land conservation and human health. In this review, Hine and colleagues examine 70 studies related to the benefits of wilderness and nature-based experiences. Hine and colleagues describe numerous characteristics of these studies, including their methodological type (e.g., qualitative or quantitative), outcomes measured, location of the programs they evaluated, types of experiences (e.g., therapeutic intervention or general experience), and age and gender of participants. In examining study results, the authors found that wilderness and nature-based experiences resulted in a range of benefits including: physical and mental health benefits (e.g., reduced body fat, reduced anxiety and stress, and improved self-esteem); positive changes in behavior; enhanced connectedness to nature; and improved knowledge and skills acquisition. Hine and colleagues discuss limitations to the reviewed studies, including the lack of quantitative and longitudinal studies, small sample sizes, and the lack of control groups. The authors highlight the need for additional research to address current limitations and provide specific research recommendations.

Author Affiliation: Rachel Hine is with the University of Essex in the UK.

Hine, R., Pretty, J., & Barton, J. (2009). *Research project: Social, psychological and cultural benefits of large natural habitat & wilderness experience*. University of Essex. This report is available online at:
<http://www.essex.ac.uk/ces/occasionalpapers/Kerry/Literature%20Review%20for%20WF.pdf>

Place attachments are important to children's well-being

In this article, Jack reviews evidence about the relationship between place attachments and children's well-being. He discusses the meaning of place and place attachments and how place attachments develop in children. Jack also reviews evidence about how children use space, the various influences (from individual to family and community) on children's use of space, and how use of space affects place attachments. He then discusses studies that have found significant declines in children's independent mobility or freedom to use their local environment and factors contributing to this decline. Jack highlights three social policy approaches (*laissez-faire*, service-oriented, and space-oriented) and related programs in the UK and their impacts on children's independent use of their local environments. In the last section of this review, the author discusses the importance of place attachments for children who are in the social-care system and the lack of current focus on children's attachments to place in favor of attachments to people. Importantly, Jack provides suggestions on how people working with children in the social system can better support their place attachments and well-being.

Author Affiliation: Gordon Jack is with Durham University in the UK.

Jack, G. (2010). Place Matters: The Significance of Place Attachments for Children's Well-Being. *British Journal of Social Work*, 40(3), 755-771. This study may be available in a library near you or can be purchased online through the publisher at: <http://bjsw.oxfordjournals.org/>

Being physically active outdoors and in nature can improve children's health

Many children in the U.S. today have chronic health conditions such as obesity, asthma, and attention deficit/hyperactivity disorder. In this article, McCurdy and colleagues review the current status of children's health, including children's physical inactivity; increasing obesity; the prevalence of obesity-related diseases such as type 2 diabetes and hypertension; vitamin D deficiency; and mental health challenges such as depression and anxiety. The authors then review evidence regarding the benefits of physical activity, and in particular physical activity outdoors and in natural environments. In addition, the authors discuss the benefits natural environments can have on children's mental health, as well as additional potential health benefits, including improving asthma and nearsightedness. In concluding their article, McCurdy and colleagues examine the important role that pediatric health care providers play in the management of childhood obesity and other chronic health challenges. The authors review current guidance available to pediatricians and discuss a new initiative—The Children and Nature Initiative—which works with pediatric health care providers to increase the amount of time that children spend outside being physically active and in nature as a way to address chronic conditions and improve children's health.

Author Affiliation: Leyla McCurdy is with the National Environmental Education Foundation in Washington D.C.

McCurdy, L. E., Winterbottom, K. E., Mehta, S. S., & Roberts, J. R. (2010). Using nature and outdoor activity to improve children's health. *Current Problems in Pediatric and Adolescent Health Care*, 40(5), 102-117. This study may be available in a library near you or can be purchased online through the publisher at: [http://www.cppah.com/article/S1538-5442\(10\)00044-1/abstract](http://www.cppah.com/article/S1538-5442(10)00044-1/abstract) [http://](http://www.cppah.com/article/S1538-5442(10)00044-1/abstract)

Original Research:

Pregnant women living in areas with more trees had better birth outcomes

Donovan and colleagues investigated the effect that urban trees might have on adverse birth outcomes, including preterm birth and small for gestational age. Researchers examined all single live births in Portland, Oregon in 2006 and 2007 where the woman lived in a single-family home (approximately 5,700 women). Researchers also classified the amount of trees around each woman's home. In examining the relationship between tree cover and birth outcomes, Donovan and colleagues found that women who had more trees within 50 meters of their home, and who lived close to a private open space, had a significantly lower risk of having a baby being born that was small for gestational age. In fact, researchers found that a 10% increase in tree cover reduced the number of small for gestational age births by 1.42 in 1,000 births. Donovan and colleagues found no

significant relationship between tree cover and preterm birth. While it is not known how trees might improve birth outcomes, researchers discuss several possible mechanisms, including stress reduction, improved social contacts, and increased physical activity. This study may be limited due to its observational nature, but through its large sample size and control of numerous individual and neighborhood factors, it highlights a valuable new area for future research on nature-health connections.

Author Affiliation: Geoffrey Donovan is with the USDA Forest Service in Portland, Oregon.

Donovan, G. H., Michael, Y. L., Butry, D. T., Sullivan, A. D., & Chase, J. M. (2010). Urban trees and the risk of poor birth outcomes. *Health & Place*. 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

Urban and rural brains respond differently to stress

Over the years, a number of studies have found that city living increases the risk of certain mental health problems, such as mood and anxiety disorders, and is thought to be linked to stresses in the urban social environment. In this study, Lederbogen and colleagues placed 32 healthy German volunteers from urban areas, towns, and rural areas under stress and used functional magnetic-resonance imaging (fMRI) to scan their brains and examine their neural processes. In addition to examining where participants currently live (city, town, or country), researchers also assessed where participants grew up along the country to city spectrum. In analyzing the data, Lederbogen and colleagues found that urban and country residents' brains handled the stress from the experiment differently in that different parts of their brains were activated. Researchers discovered that people living in the country had the lowest levels of activity in their amygdalas, structures responsible for processing and memory of emotional reactions such as environmental threats, while people living in towns had higher levels, and people living in the city had the highest levels of activity in their amygdalas. In addition, Lederbogen and colleagues discovered that whether people grew up in the city or country differentially impacted their perigenual anterior cingulate cortex (pACC), structures in the brain that helps regulate the amygdalas. Researchers found that people who spent more time growing up in the city had a more active pACC under stress, regardless of where they currently live. Importantly, Lederbogen and colleagues conducted two other similar experiments, one using a different stress test and the other using a different sample of participants, and found the same results. In addition, researchers examined the functional connectivity between the pACC and amygdalas and found that urban upbringing was associated with reduced connectivity, while current urban living had no impact, highlighting the importance of early urban exposure on brain processes. While this study may be limited due to its small sample size and inability to prove a causal relationship, it provides an important new understanding of the neural effects of different living environments on social stress processing.

Author Affiliation: Florian Lederbogen is with the University of Heidelberg in Germany.

Lederbogen, F., Kirsch, P., Haddad, L., Streit, F., Tost, H., Schuch, P., et al. (2011). City living and urban upbringing affect neural social stress processing in humans. *Nature*, 474(7352), 498-501. This article may be available in a library near you or can be purchased online through the publisher at: <http://www.nature.com/nature/index.html>

Children who spend more time in outdoor sport activities and less time watching TV have better retinal microvascular structure

The condition of small (micro) blood vessels is critical to good health. Retinal blood vessels provide a unique opportunity to study microvascular health noninvasively and have been linked to cardiovascular disease risk factors and blood pressure. In this study, Gopinath and colleagues examined relationships between children's physical activity, sedentary behaviors, and retinal microvascular size. Researchers had the parents of almost 1,500 6-year-old children from 34 different schools in Sydney, Australia complete surveys regarding their children's physical activity (outdoor and indoor) and sedentary behavior. Researchers also took digital photographs of children's eyes and measured retinal vessel diameter. In analyzing the data, Gopinath and colleagues found that, on average, children spent 36 minutes per day engaged in physical activity and 1.9 hours per day engaged in screen time. In examining relationships between children's physical activity, sedentary behaviors, and retinal microvascular size, researchers found that children who engaged in more physical activity outdoors had better retinal vascular diameter (wider arterioles), while children who engaged in more screen time had worse retinal vascular diameter (narrower arterioles). Interestingly, researchers did not find a significant relationship between indoor sporting activities and children's retinal vascular diameter. Gopinath and colleagues also discovered that the size of arterial narrowing associated with each daily hour children watched TV was fairly comparable to a 10-mm Hg increase in systolic blood pressure. This study may be limited due to its reliance on parent reports and relationships examined are correlational (not causal). While additional research is needed to understand these relationships, researchers discuss how retinal arteriolar narrowing could be a potential indicator of future cardiovascular disease and thus efforts to decrease the amount of time children watch TV and increase the amount of time children spend in outdoor activities could be particularly valuable to improving children's health.

Author Affiliation: Bamini Gopinath is with the University of Sydney in Australia.

Gopinath, B., Baur, L. A., Wang, J. J., Hardy, L. L., Teber, E., Kifley, A., et al. (2011). Influence of Physical Activity and Screen Time on the Retinal Microvasculature in Young Children. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 31(5), 1233. This study may be available in a library near you or can be purchased online through the publisher at: <http://atvb.ahajournals.org/>

An outdoor program enhances children's well-being, physical activity, and feelings of health, safety, and satisfaction

Many children in their teenage years face mental health challenges. Several studies have found that contact with nature and physical activity in a natural environment, what some call "green exercise,"



improves psychological well-being. In this study, Wood and colleagues evaluated the impact of the Youth Outdoor Experience (YOE) project on participating children's well-being and physical activity. The YOE project provides 11- to 18-year-old children from disadvantaged urban areas in England with opportunities to participate in a 12-week program where children engage in weekly structured outdoor activities. As part of this study, researchers had 14 participants complete a questionnaire to assess their well-being, connectedness to nature, and physical activity. Researchers also had 114 participants complete a questionnaire to assess the impact of the project on a range of well-being areas (e.g., being healthy, staying safe, and enjoying and achieving). Most participants completed both questionnaires at the start, middle, and end of the project. In analyzing the data, Wood and colleagues found a number of interesting results, including:

- Participants' well-being increased from the start to the end of the program.
- Participants' contact with nature varied a lot over the course of the project.
- Participants increased the number of days that they performed 30 minutes of moderate physical activity.
- Project leaders reported positive changes in participants' attitudes, self-esteem, and behavior.
- Participants reported feeling healthier, safer, and more positive with regard to their school, home, and social lives, as well as their achievements.

While this study may be limited due to its small sample size and reliance on self-report measures, it highlights the need for additional research in this area and the potential role that nature-based activities can have on participants' well-being, physical activity, and feelings of health, safety, and satisfaction.

Author Affiliation: Carly Wood is with the University of Essex in the UK.

Wood, C., Hine, R., & Barton, J. (2011). *The health benefits of the Youth Outdoor Experience (YOE) project*. University of Essex. This report may be available through the University of Essex, Suffolk Wildlife Trust, or Natural England.

The Berkeley School Lunch Initiative enhances students' preference for and consumption of healthy foods, nutrition knowledge, and food-related attitudes

In 2005, the Berkeley Unified School District started the School Lunch Initiative and phased the Initiative into schools from 2006 to 2009. The School Lunch Initiative is a collaborative partnership that was developed to improve student health and understanding of sustainable food systems. The Initiative is a comprehensive program that features hands-on cooking classes, food and dining services changes, and curriculum changes. Rauzon and colleagues evaluated the School Lunch Initiative to examine its effects on students' eating behaviors, attitudes about healthy eating and environmental responsibility, and knowledge about nutrition and food and the environment. To evaluate program impacts, researchers compared over 200 4th and 5th grade students over a period of 3 years from 4 different schools—2 with highly developed School Lunch Initiative programs and 2 with lesser-developed School Lunch Initiative programs. Participants completed food diaries and answered questionnaires about their knowledge, attitudes, and behaviors as they related to nutrition, food, and the environment. In addition, researchers conducted interviews with school staff,



observed food service environments, collected information on students' academic test scores and body mass index, and had parents of participating students complete a survey related to family and neighborhood characteristics. In analyzing the data, Rauzon and colleagues found that the School Lunch Initiative had positive impacts on students' nutrition knowledge, preference for and consumption of healthy foods, and food-related attitudes. A few of their findings include:

- *Parents reported that the program positively impacted their child's eating habits.* For example, 35% of parents with children in schools with advanced programs reported that school had improved their child's eating habits, as compared to 16% of parents with children in schools with lesser-developed programs.
- *Students' nutrition knowledge was higher.* Students attending schools with advanced programs had higher nutrition knowledge scores, compared to students attending schools with lesser-developed programs.
- *Younger students preferred more fruits and vegetables.* Younger students attending schools with advanced programs preferred more fruits and vegetables as compared to students attending schools with lesser-developed programs. These differences, however, with the exception of green leafy vegetables, disappeared as students moved into higher grades.
- *Middle school students had more positive food-related behaviors.* Middle school students attending schools with advanced programs had more positive attitudes toward eating school food and agreed more often that produce tasted better in-season and that eating choices can impact the environment, as compared to students attending schools with lesser-developed programs.
- *Younger students ate more fruits and vegetables.* Younger students attending schools with advanced programs ate nearly 1.5 more servings of fruits and vegetables daily as compared to students in schools with lesser-developed programs where consumption actually decreased by 0.4 servings.

Researchers also examined the impact of school programs on students' academic test scores and body mass index, but found no significant differences between students in advanced versus lesser-developed programs, which may have been due to the small sample size or length of time examined. This report provides a valuable contribution regarding the impact that innovative school programs can have on students' food-related behavior and attitudes. Researchers conclude their report with a series of recommendations to help enhance the current program and/or apply the program in other school districts.

Author Affiliation: Suzanne Rauzon is with the University of California at Berkeley.

Rauzon, S., Wang, M., Studer, N., & Crawford, P. (2010). *An evaluation of the school lunch initiative*. Berkeley, CA: University of California at Berkeley. This report is available online at: http://cwh.berkeley.edu/sites/default/files/primary_pdfs/An_Evaluation_of_the_School_Lunch_Initiative_Final%20Report_9.22.10.pdf

Vitamin D deficient children are more likely to become obese over time

Vitamin D is essential for calcium absorption and may be important for numerous other bodily processes. Vitamin D is primarily produced in the skin after exposure to sunlight. Previous studies have found that vitamin D deficiency might be a risk factor for childhood obesity, however, these studies have been limited because they have examined this relationship at one point in time (a cross-sectional design) and thus causality could not be determined. In this study, Gilbert-Diamond and colleagues investigated the relationship between vitamin D levels and various indicators of obesity over a 3-year period in a representative sample of nearly 500 low- and middle-income school-age children (5-12 years of age) from Bogota, Columbia. To examine this relationship, researchers collected a baseline blood sample from each child and various body measurements (e.g., height, weight, skinfold thickness, and waist circumference), and had parents complete a socio-demographic survey. Researchers collected body measurements from children each year for 3 years. Gilbert-Diamond and colleagues found that 11% of children were overweight, 10.2% were vitamin D deficient, and 46.4% were vitamin D insufficient. In examining the relationship between vitamin D levels and obesity measures, researchers found that vitamin D deficient children had a greater increase in body mass index over time as compared to vitamin D sufficient children. Researchers also found that vitamin D deficient children had a greater increase in their skinfold-thickness ratio and waist circumference, as compared to vitamin D sufficient children. In addition, Gilbert-Diamond and colleagues examined the relationship between vitamin D levels and children's linear growth (i.e., height). In examining the data, researchers found that vitamin D deficient girls had slower linear growth than vitamin D sufficient girls. While this study may be limited due to its measurement of vitamin D levels at baseline only, its assessment of body measurements over time and use of a large, representative sample provides a valuable contribution to the literature and our understanding of the relationship between vitamin D levels and obesity.

Author Affiliation: Diane Gilbert-Diamond is with Harvard University and Dartmouth College.

Gilbert-Diamond, D., Baylin, A., Mora-Plazas, M., Marin, C., Arsenault, J. E., Hughes, M. D., et al. (2010). Vitamin D deficiency and anthropometric indicators of adiposity in school-age children: a prospective study. *The American Journal of Clinical Nutrition*, 92(6), 1446. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.ajcn.org/>

Children with ADHD functioned better in the woods than in a built setting

Several studies have found that contact with nature may reduce symptoms of attention-deficit hyperactivity disorder (ADHD) in children. To build upon this work, van den Berg and van den Berg examined the behavior and cognitive and emotional functioning of 12 children, between the ages of 9 and 17, enrolled in a care program for children with ADHD at two farms in the Netherlands. As part of this study, researchers observed and tested the two groups of children during visits to a wooded area and a nearby town on consecutive days. At both of these locations, researchers observed children participating in a group activity (e.g., building a cabin or exploring a neighborhood), and had children evaluate their experience, describe their mood, and take a concentration test. In analyzing the data, van den Berg and van den Berg found that both groups

performed better on a concentration task in the woods than in the town, however, they found that children's behavior and emotional functioning in the two settings differed. Researchers found that children in one group liked the woods better than the town and had more positive behaviors and feelings in the woods, whereas children from the other group liked the town and woods equally and displayed positive behaviors in both settings, although they showed somewhat less positive behaviors overall in the town than in the woods. While this study may be limited due to its small sample size and inability to control for a number of potentially influencing factors, its findings, in conjunction with previous research, suggest that the natural environment may help children better cope with ADHD.

Author Affiliation: A.E. van den Berg is with Wageningen University and Research Center in The Netherlands.

Van Den Berg, A., & Van Den Berg, C. A comparison of children with ADHD in a natural and built setting. *Child: Care, Health and Development.* This study may be available in a library near you or can be purchased online through the publisher at: <http://www.wiley.com/bw/journal.asp?ref=0305-1862>

Children with ADHD who regularly play in green settings have milder symptoms than children who play in built outdoor and indoor settings

In the United States, an estimated 4.4 million children have been diagnosed with Attention Deficit/Hyperactivity Disorder (ADHD). In this study, Faber Taylor and Kuo examined whether routinely experienced greenspaces—those that children visit on a daily or near daily basis—impact children's ADHD symptoms. Researchers collected data via an internet survey from 421 parents of 5- to 18-year-old children with ADHD. Parents provided information about where their child played most of the time during the past week and the severity of their child's ADHD symptoms. In analyzing the data, Faber Taylor and Kuo found that most children played in one of five settings: 1) Places where there are big trees and grass (Big Trees & Grass); 2) Places indoors where it feels very much indoors (Indoors); 3) Places where there is a lot of open grass (Open Grass); 4) Places that are paved or built (Built Outdoors); and 5) Other. Researchers examined the relationship between these five settings and the severity of children's ADHD symptoms and found that children who regularly play in green play settings (Big Trees & Grass and Open Grass) have milder ADHD symptoms than children who play in built outdoor and indoor settings. Importantly, Faber Taylor and colleagues found that the impact of green play settings on children's ADHD symptoms did not vary based on family income or the child's gender. Interestingly, in examining differences between children with hyperactivity (ADHD) and without hyperactivity (ADD), researchers found that for children with hyperactivity only one of the green play settings—Open Grass—is associated with less severe symptoms, while for children without hyperactivity both green play settings—Open Grass and Big Trees & Grass—are associated with less severe symptoms. This study may be limited due to its reliance on parental reports and is correlational (not causal) in nature, however, it provides a valuable contribution to the growing research in this area as it is the first large study to examine linkages between greenspace exposure and ADHD symptoms. Faber Taylor and colleagues conclude their article by discussing the potential role of greenspace exposure to ADHD management and the

need for randomized control trials to strengthen our understanding of the relationship between nature and ADHD symptoms.

Author Affiliation: Faber Taylor is with the University of Illinois at Urbana-Champaign.

Faber Taylor, A., & Kuo, F. E. M. (2011). Could exposure to everyday green spaces help treat ADHD? Evidence from children's play settings. *Applied Psychology: Health and Well-Being*. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.wiley.com/bw/journal.asp?ref=1758-0846>

Plants in classrooms benefit students' emotions, behavior, and health

The classroom environment can play an important role in students' learning and academic performance. Han examined the effect of living plants in a classroom on students' psychology, behavior, and health. To investigate this relationship, he conducted a study with two similar classrooms, located next to each other, of sophomore students at a high school in Taiwan. Han used surveys every 2 weeks to assess students' emotions and collected objective information on students' academic performance, health, and behavior. After an initial assessment period, he brought six small trees into the back of one of the classrooms. In comparing data from the two classrooms, Han found that shortly after the plants were introduced, students had significantly higher scores than the regular classroom in terms of preference, comfort, and friendliness. In addition, he found that students in the classroom with plants had significantly fewer sick leave hours and punishment records than students in the regular classroom. While this study may be limited due to its small sample size and there is the potential that other variables may have influenced the results, Han's research provides valuable insight into the benefits that even small amounts of nature can provide to students and suggests promising avenues for future research.

Author Affiliation: Ke-Tsung Han is with National Chin-Yi University of Technology in Taiwan.

Han, K. T. (2009). Influence of Limitedly Visible Leafy Indoor Plants on the Psychology, Behavior, and Health of Students at a Junior High School in Taiwan. [Article]. *Environment and Behavior*, 41(5), 658-692. This study may be available in a library near you or can be purchased online through the publisher at: <http://eab.sagepub.com/>

Preschool children experiencing a weekly outdoor lesson have improved self-efficacy and early literacy skills

The Outdoor Discovery Center Macatawa Greenway—a non-profit entity that delivers outdoor, nature-based education and programming in Holland, MI—developed a nature-based program intervention to improve the health and well-being of preschool children and their families. As part of the intervention, naturalist educators visited six preschools on a weekly basis to deliver an hour-long lesson focused on a science concept that was taught through outdoor activities. To understand the impact of the intervention on students, Trent-Brown and colleagues examined a number of health and well-being measures for over 100 preschool students, between the ages of 3 and 5, prior

to and 6 months after the intervention began in both an experimental group that received the intervention, as well as a control group that did not receive the intervention. Researchers measured children's blood pressure, body mass index (BMI), activity preferences, self-efficacy, and early literacy skills. In analyzing the data for experimental and control groups, Trent-Brown and colleagues found that preschool students in the nature intervention program had significantly improved with regard to their self-efficacy and early literacy skills when compared to the control group. In examining relationships between outcomes for the control and experimental groups, researchers found that there was a more significant and positive relationship between activity preferences and self-efficacy and early literacy skills for the experimental group as compared to the control group, indicating that children with more active preferences tended to improve more with regard to self-efficacy and early literacy skills. While there were notable positive outcomes, researchers also found that preschool students in the nature intervention program had significantly elevated mean arterial blood pressure scores, as well as significant increases in the number of students classified as prehypertensive as compared to the control group, which did not experience these increases. With regard to BMI and activity preferences, researchers found no significant changes among the experimental or control groups. While this study may be limited due to student and teacher turnover in the classrooms, as well as a number of other factors that were not controlled as part of the study and therefore might influence study outcomes, such as nutrition and family health history, it provides an important contribution to the literature about the impact of nature programs on children's health and well-being. Importantly, this study will continue in future years, providing important information about the long-term impact of nature programs on students.

Author Affiliation: Trent-Brown is with Hope College in Holland, MI.

Trent-Brown, S. A., Vanderveen, J. D., Cotter, R., Hawkins, K., Schab, A., Dykstra, S., et al. (2011). *Effects of a nature-based science enrichment program on preschool children's health, activity preferences, self-efficacy, and cognition. Outdoor Discovery Center Macatawa Greenway.* This report may be available via the Outdoor Discovery Center Macatawa Greenway at <http://odcofwu.schoolwires.com/odcofwu/site/default.asp>

Focus: Physical Activity/Fitness & Weight

These articles investigate linkages between the design of children's environments, children's outdoor-related behavior, and their physical activity/fitness and weight.

Research Syntheses:

Parks and playgrounds encourage physical activity

In this report, Mowen synthesizes research about the relationship between parks and healthy, active lifestyles. He reviews studies across a range of populations, including children, adults, seniors, lower-

income families, and various racial and ethnic groups. Mowen reports a number of key findings. A few findings that pertain to children include the following:

- Children who live in close proximity to parks, use parks more and engage in more physical activity.
- Not everyone has equal access to parks. Lower-income populations and some racial and ethnic populations have poor access to parks.
- Certain park features seem to encourage more physical activity. For example, one study found that girls living close to parks with good lighting were more physically active.
- Perception of neighborhood safety influences whether parents encourage their children to use local playgrounds.
- Organized park programs and supervision may increase children's use of parks and their physical activity.
- Park renovations can increase children's use of playgrounds and their level of physical activity.

In concluding his literature review, Mowen highlights areas where future research is needed to continue to build the evidence base related to parks and active living.

Author Affiliation: Andrew Mowen is with The Pennsylvania State University.

Mowen, A. J. (2010). *Parks, playgrounds and active living*. Robert Wood Johnson Foundation. This report is available online at: <http://www.activelivingresearch.org/resourcesearch/summaries>

Children's built environments influence their access to nutritious foods and physical activity

In this literature review, Rahman and colleagues examine the relationship between built environment characteristics and childhood obesity. The authors examine the role of the built environment in supporting physical activity, providing access to healthy foods, and limiting access to unhealthy foods. For example, the authors review evidence concerning students' access to fast-food restaurants and the benefits that can be gained from participation in neighborhood and/or school gardens. Rahman and colleagues also examine the role of the built environment in providing opportunities for children to be physically active. For example, the authors review evidence regarding neighborhood factors that influence how children get to and from school, as well as how often they are active outdoors. Rahman and colleagues conclude that changes to our built environment can help children be more active and eat healthier diets and can result in long-term, positive solutions to childhood obesity. The authors suggest different ways in which health professionals can help make positive changes in the built environment.

Author Affiliation: Tamanna Rahman is with the University of California at Los Angeles.

Rahman, T., Cushing, R. A., & Jackson, R. J. (2011). Contributions of Built Environment to Childhood Obesity. *Mount Sinai Journal of Medicine: A Journal of Translational and Personalized Medicine*, 78(1), 49-57. This study may be available in a library near you or can be purchased online through the publisher at: [http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1931-7581](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1931-7581)

Original Research:

Children who play more outside and watch less TV have lower BMIs

Kimbro and colleagues investigated linkages between outdoor play and TV watching and children's weight status, as well as linkages between the quality of children's residential environments and their activities. Researchers examined data for over 1,800 5-year-old children in major U.S. cities that took part in a large, longitudinal study on child well-being. Kimbro and colleagues examined children's body mass index (BMI), physical and sedentary activities as reported by mothers, various background and neighborhood characteristics, neighborhood social cohesion as reported by mothers (e.g., whether people are willing to help their neighbors), and physical conditions of the residential environment as measured by researchers (e.g., amount of litter nearby). Researchers found that 19% of children were overweight (between the 85th and 95th percentile) and 16% were obese (95th percentile or higher). Interestingly, Kimbro and colleagues found that children in the highest and lowest socioeconomic brackets had the lowest BMIs, while children in the middle socioeconomic brackets had the highest BMIs. Researchers also found that, on average, children played outside about 2 hours a day and watched television for more than 2.5 hours a day. In examining relationships between outdoor play, TV watching and children's weight, Kimbro and colleagues discovered that children who played more outdoors had lower BMIs, while children who watched more TV had higher BMIs. Researchers also found that the higher the ratio of outdoor time to television time, the lower the child's BMI. Kimbro and colleagues also investigated socio-demographic differences in children's outdoor and TV watching behavior. For example, researchers found that Black and Hispanic children spent less time outside than White children, but more time watching TV than White children. In examining the relationship between the quality of children's residential environments and activities, Kimbro and colleagues discovered that children whose mothers had higher perceptions of neighborhood social cohesion, played outside more, spent fewer hours watching TV, and made more trips to the park or playground. Interestingly, the researchers found that children living in public housing and areas with poorer neighborhood physical conditions played outside more and yet also watched more TV. Based on previous studies, Kimbro and colleagues suggest that children living in public housing and areas with poorer neighborhood physical conditions may have more unstructured time than children living in other conditions and thus are able to fill this time with more outdoor play as well as more television watching. While this study may be limited due to its reliance on mother-reported information and its inclusion of more poor and urban children, it provides a valuable addition to the literature regarding the role that children's environments have on their active and sedentary behavior.

Author Affiliation: Rachel Tolbert Kimbro is with Rice University.

Kimbro, R. T., Brooks-Gunn, J., & McLanahan, S. (2011). Young Children in Urban Areas: Links Among Neighborhood Characteristics, Weight Status, Outdoor Play, and Television-Watching. *Social Science & Medicine*. This study may be available in a library near you or can be purchased online through the publisher at: <http://journals.elsevier.com/02779536/social-science-and-medicine/>

Children with better access to public parks and recreation programs are less likely to have significant increases in BMI over time

Wolch and colleagues investigated whether proximity to parks and recreational programs impacts the development of childhood obesity. Researchers gathered information on over 3,000 children, aged 9-10, from 12 communities in Southern California over an 8-year period. As part of this study, participants completed surveys and researchers measured children's height and weight on an annual basis. In addition, researchers evaluated public parks and recreation programs around children's homes. Wolch and colleagues found that 20% of children did not have access to recreation programs within 10km of their home and that over 50% of children did not have a park within 500m of their home. In examining the relationship between access to parks and recreation programs and children's body mass index (BMI), researchers found that children with better access to parks within 500m of their homes and recreation programs within 10km of their homes had a reduced risk of being overweight or obese at age 18. Wolch and colleagues found that the impact of recreation programs and parks was stronger for boys than girls and that the impact of recreation programs on BMI was stronger than that of parks. While this study did not consider private recreation space and programs or the influence of children's dietary intake, it provides a valuable contribution to the literature and demonstrates the important role that public parks and recreation programs can play in reducing the risk of childhood obesity.

Author Affiliation: Jennifer Wolch is with the University of California, Berkeley.

Wolch, J., Jerrett, M., Reynolds, K., McConnell, R., Chang, R., Dahmann, N., et al. (2010). Childhood obesity and proximity to urban parks and recreational resources: A longitudinal cohort study. *Health & Place*. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.elsevier.com/>

Children who spend more time outside are more physically active

Time spent outside is one potential factor that may influence children's physical activity. While previous studies have examined the relationship between time spent outside and children's physical activity, they have been limited due to their reliance on methods that use self-report, parent report, or direct observation. In this study, Cooper and colleagues used global positioning system (GPS) receivers to record the outdoor location of over 1,000 11-year-old children in the UK and matched this information with data from accelerometers that measured children's physical activity. Children wore the GPS units and accelerometers after school for four days. In analyzing the data, Cooper and colleagues found that children spent, on average, about 42 minutes outside after school each day. Researchers also found that children spent more time outdoors in the summer than in the winter months and that there were no significant differences between boys and girls with regard to time spent outside. In terms of physical activity, Cooper and colleagues found that physical activity was 2-3 times higher outside than inside, physical activity outdoors was higher in the summer than in the winter months, and that there was no seasonal variation in physical activity that took place indoors. In examining the relationship between time spent outside and physical activity, researchers found that the more time children spent outside, the more physically active they were. This study may be

limited due to user operation of the instruments as well as misclassification of indoor/outdoor locations, however, it provides further evidence of the important linkage between children's time spent outside and their physical activity levels. This study also demonstrates the potential of combining GPS and accelerometer data to advance our understanding of this relationship.

Author Affiliation: Ashley Cooper is with the University of Bristol in the UK.

Cooper, A. R., Page, A. S., Wheeler, B. W., Hillsdon, M., Griew, P., & Jago, R. (2010). Patterns of GPS measured time outdoors after school and objective physical activity in English children: the PEACH project. *International Journal of Behavioral Nutrition and Physical Activity*, 7. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.ijbnpa.org/>

Urban children are most active in gardens and street environments

Jones and colleagues investigated environments where children are physically active. Researchers had 100 children between the ages of 9 and 10 from urban and rural locations in Norfolk, UK wear accelerometers and global positioning system receivers for 4 days during the summer to track their locations and physical activity. In analyzing the data, Jones and colleagues identified all 5 minute bouts of moderate to vigorous physical activity and matched this activity to children's locations with a geographic information system. Researchers found that boys were more active than girls and that children who spent more time outside were more active than children who spent less time outside, especially for girls and children living in rural locations. In addition, Jones and colleagues discovered that children were more active in their neighborhoods, but that boys and rural children engaged in more moderate to vigorous physical activity outside their neighborhoods. With regard to environments for physical activity, researchers found that urban children most commonly used gardens and the street environment for their moderate to vigorous physical activity, while rural children most commonly used farmland and grassland. While this study may be limited due to its small sample size, the researchers' use of objective measures provides a new and valuable way to understand supportive environments for children's physical activity.

Author Affiliation: Esther van Sluijs is with the Institute of Metabolic Science in the UK.

Jones, A. P., Coombes, E. G., Griffin, S. J., & van Sluijs, E. M. F. (2009). Environmental supportiveness for physical activity in English schoolchildren: a study using Global Positioning Systems. *International Journal of Behavioral Nutrition and Physical Activity*, 6. This article may be available in a library near you or can be purchased online through the publisher at: <http://www.ijbnpa.org/>

9-year-old children who play outdoors after school and 15-year-old children who participate in sport clubs are more physically active

Many efforts aimed at preventing childhood obesity have targeted increasing physical activity. To successfully increase physical activity levels it is important to understand factors that influence children's physical activity. In this study, Nilsson and colleagues investigated four leisure time

behaviors and their relationship to physical activity: 1) mode of transportation to school; 2) outdoor play after school; 3) participation in sport and exercise clubs; and 4) TV viewing. Researchers analyzed data for over 1,300 9- and 15-year-old children from three European countries (Norway, Estonia, and Portugal). Nilsson and colleagues measured children's moderate to vigorous physical activity with accelerometers and their leisure activities via a self-report questionnaire. In analyzing the data, researchers found significant differences between age and gender groups. For example, 9-year-olds more frequently reported active commuting, outdoor play, and exercise in clubs as compared to 15-year-olds; while boys reported playing more outdoors after school than girls. With regard to physical activity levels, researchers found that 9-year-olds were significantly more active than 15-year-olds and that boys were significantly more active than girls. In examining relationships between leisure activities and physical activity, Nilsson and colleagues discovered that playing outdoors after school was associated with higher physical activity levels for 9-year-olds, while participating in sport clubs was associated with higher physical activity levels for 15-year-olds. These results indicate that children's physical activity behavior changes as they age. Nilsson and colleagues did not find a relationship between active commuting or TV viewing and physical activity levels. Researchers also did not find relationships between leisure time behaviors and the amount of time children spent being sedentary, suggesting that there may be different factors that influence sedentary behavior and physical activity. Although this study could not examine causation and may be limited due to its use of self-reported information, it provides useful information about leisure time behaviors that influence children's moderate-to-vigorous physical activity levels, which can help inform interventions designed to enhance children's health.

Author Affiliation: Andreas Nilsson is with Örebro University in Sweden.

Nilsson, A., Andersen, L. B., Ommundsen, Y., Froberg, K., Sardinha, L. B., Piehl-Aulin, K., et al. (2009). Correlates of objectively assessed physical activity and sedentary time in children: a cross-sectional study (The European Youth Heart Study). *BMC Public Health, 9* This study may be available in a library near you or can be purchased online through the publisher at: <http://www.biomedcentral.com/bmcpublichealth/>

Having other children that play outdoors helps minimize physical activity declines in adolescent girls

Previous research has demonstrated a decline in children's physical activity in the middle-school years. To gain additional insight into factors that might be associated with this physical activity decline, Evenson and colleagues investigated relationships between perceived neighborhood characteristics and transportation and adolescent girls' non-school physical activity and sedentary behavior over a 2 year period. Researchers had nearly 850 girls from 36 schools in 6 states wear accelerometers for 6 days and complete a questionnaire about their neighborhood environment and after-school transportation when they were in the 6th and 8th grades. In analyzing the data, Evenson and colleagues found that girls' non-school moderate to vigorous physical activity declined between the 6th and 8th grades, while non-school sedentary behavior increased. With regard to the relationship between perceived neighborhood characteristics and transportation and declines in girls' physical



activity, researchers found three significant factors, 2 of which were counter to the researchers' expectations: 1) reporting that other children do not play outdoors in their neighborhood was associated with physical activity declines; 2) reporting that their neighborhood was well lit was associated with physical activity declines; and 3) reporting that there were trails in their neighborhood was associated with physical activity declines. The authors discuss several potential explanations for their findings, including that these relationships change as children age. In addition, Evenson and colleagues found no relationships between neighborhood and transportation characteristics and changes in girls' non-school sedentary behavior, which suggests there may be different factors impacting children's physical activity and sedentary behaviors. While additional research is needed to understand determinants of the decline in children's physical activity, this study's longitudinal design and use of an objective physical activity measure makes an important contribution to the literature.

Author Affiliation: Kelly Evenson is with the University of North Carolina, Chapel Hill.

Evenson, K. R., Murray, D. M., Birnbaum, A. S., & Cohen, D. A. (2010). Examination of perceived neighborhood characteristics and transportation on changes in physical activity and sedentary behavior: The Trial of Activity in Adolescent Girls. *Health & Place, 16(5), 977-985.* This article may be available in a library near you or can be purchased online through the publisher at: <http://www.elsevier.com/>

Children have higher physical activity levels in greenspace as compared to non-greenspace

Wheeler and colleagues investigated children's physical activity after school in outdoor greenspace, outdoor non-greenspace, and indoors. Researchers examined over 1,000 10- to 11-year-old children's after school physical activity locations and levels by having children wear accelerometers for 7 days and global positioning system receivers for 4 days between the end of school and bedtime. In analyzing the data, Wheeler and colleagues found that children spent only 13% of their time outdoors and most of this time was spent in non-greenspace (11%) as compared to greenspace (2%). Researchers discovered, however, that 30% of children's physical activity and 35% of their moderate to vigorous physical activity occurred outdoors, with more intense physical activity occurring in greenspace as compared to non-greenspace, especially for boys. For example, boys were 1.37 times more likely (and girls 1.08 times more likely) to engage in moderate to vigorous physical activity in greenspace as opposed to non-greenspace. While this study may be limited due to potential misclassification of indoor and outdoor time, the researchers' use of objective measurement instruments and a large dataset helps improve our understanding of the role of specific land uses in supporting children's physical activity. As a result of their research, Wheeler and colleagues suggest that both green and non-green urban environments may be important to children's physical activity.

Author Affiliation: Benedict Wheeler is with the University of Bristol in the UK.

Wheeler, B. W., Cooper, A. R., Page, A. S., & Jago, R. (2010). Greenspace and children's physical activity: A GPS/GIS analysis of the PEACH project. *Preventive Medicine, 51*(2), 148-152. This article may be available in a library near you or can be purchased online through the publisher at: <http://www.elsevier.com/>

Green areas on elementary school grounds support the highest level of children's moderate physical activity

Dyment and colleagues examined the relationship between school ground design and children's physical activity levels. Researchers collected information from two elementary schools, one in Australia and the other in Canada. The Australian school was selected because of its diversity of play areas, while the Canadian school was selected because of its long-term school ground greening efforts. At each school, Dyment and colleagues observed the location and intensity of children's play behaviors (sedentary, moderately active, or vigorously active) during lunch and recess periods. In analyzing the data, researchers found that in Australia the greatest number of students spent time in the green area and paved sporting courts, while in Canada the greatest number of students spent time in the open asphalt area and open playing field. In terms of physical activity levels, children at both schools engaged in vigorous physical activity the most in areas with manufactured equipment (e.g., slides, swings, monkey bars, etc.), while children engaged in moderate physical activity the most in green areas (e.g., large grassy areas, gardens, etc.). With regard to children's sedentary behavior, researchers found that sedentary behavior was highest in the paved sporting courts and paved courtyard at the Australian school and the treed grassy berm, treed concrete steps, and open asphalt areas at the Canadian school. Dyment and colleagues highlight gender differences in area use, discuss their results in terms of other studies, and highlight potential design and cultural factors that might suggest why certain school ground areas are related to vigorous, moderate, and sedentary activity. While this study may be limited due to its focus on only two schools and its reliance on observational data, it demonstrates the important role that green areas on school grounds can play in enhancing children's moderate physical activity levels, especially for children who are not interested or able to play vigorous games in more traditional areas.

Author Affiliation: Janet Dyment is with the University of Tasmania in Australia.

Dyment, J. E., Bell, A. C., & Lucas, A. J. (2009). The relationship between school ground design and intensity of physical activity. *Children's Geographies, 7*(3). This study may be available in a library near you or can be purchased online through the publisher at: <http://www.tandf.co.uk/journals/titles/14733285.asp>

Children are less sedentary if they live in neighborhoods with certain environmental features

The amount of time children spend being sedentary (e.g., watching television, using the computer, or playing electronic games) is considered an important factor in childhood obesity. In this study, Veitch and colleagues investigated the relationship between features of children's physical and social neighborhood environment and the amount of time they spend in sedentary behaviors outside of school. To examine this relationship, researchers had parents of 171 5- to 6-year-old children

complete surveys in 2004 about their physical and social neighborhood environment (e.g., quality of parks, amount of social contacts, and neighborhood safety), as well as complete a survey in 2004 and 2006 about the amount of time their child spent watching TV, using the computer, and playing electronic games. In addition, children wore accelerometers in 2004 and 2006 to measure their activity levels and researchers identified and visited the public open space closest to each child to assess its features. In examining the data for 2004, Veitch and colleagues found that certain physical features of children's neighborhood environment, but not social features, influenced their sedentary behavior. Researchers found that children whose closest public open space had a water feature and who had parents that were more satisfied with public open space quality spent less time with computer/electronic games. In addition, they found that children whose closest public open space was larger spent less time watching TV. In examining data from 2004 to 2006, Veitch and colleagues found that children that lived in a cul-de-sac spent less time watching TV and children who had parents that were more satisfied with public open space quality spent less time using computer/electronic games. Contrary to their other findings, researchers discovered that children whose closest public open space had a walking path spent more time with computer/electronic games, possibly because walking paths are not important or of interest to 5-6-year-old children. This study may be limited due to its small sample size and focus on the closest public open space, however, it provides important information, using a variety of measures across multiple years, about the relationship between the built environment and children's sedentary behaviors.

Author Affiliation: Jenny Veitch is with Deakin University.

Veitch, J., Timperio, A., Crawford, D., Abbott, G., Giles-Corti, B., & Salmon, J. (2011). Is the Neighbourhood Environment Associated with Sedentary Behaviour Outside of School Hours Among Children? *Annals of Behavioral Medicine*, 1-9. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.springer.com/medicine/journal/12160>

Children living in neighborhoods where parents believe that there are good parks and sidewalks spend less time engaged in screen-based behaviors, are more physically active, and are more likely to walk or bike to and from school

Parents play a large role in determining what children can and cannot do. In this study, Carson and colleagues investigated whether parents' perceptions of their neighborhood environments are associated with children's screen time, physical activity, and active transport to and from school. Researchers gathered data from over 3,000 fifth grade students from 148 schools in Alberta, Canada. Children and parents completed several surveys on physical activity, screen time, active transport, and neighborhood perceptions. Carson and colleagues found that 59% of fifth grade students in Alberta engaged in less than 2 hours of screen time a day, 27% of students were physically active, and 39% walked or biked to and from school. In examining associations between parents' perceptions and children's screen time, physical activity, and active transport, researchers grouped parental perceptions into three areas: 1) satisfaction/services (satisfaction with where you live and access to sports, recreation, and stores); 2) safety (traffic and crime); and 3) sidewalks/parks (access to good sidewalks and parks). In analyzing the data, Carson and colleagues found that good



satisfaction/services and sidewalks/parks were associated with less screen time and more physical activity in children and neighborhoods with good sidewalks/parks were also associated with more children using active transport to and from school. Researchers found no significant associations between neighborhood safety and children's physical activity, screen time, or active transport. This study may be limited due to its reliance on child and parental reports and is correlational (not causal) in nature, however, it suggests that interventions that increase access to parks, sidewalks, and sports and recreation programs could help increase children's physical activity and active transport, while reducing their sedentary behaviors.

Author Affiliation: Valerie Carson is with the University of Alberta in Canada.

Carson, V., Kuhle, S., Spence, J. C., & Veugelers, P. J. (2010). Parents' perception of neighbourhood environment as a determinant of screen time, physical activity and active transport. *Canadian Journal of Public Health, 101(2), 124-127.* This study may be available in a library near you or can be purchased online through the publisher at: <http://jpubhealth.oxfordjournals.org/>

Children living closer to parks and greenspace participate in more active sports and have higher levels of moderate to vigorous physical activity

Outdoor spaces may be important places for children to be active, however, little is known about how specific outdoor spaces, such as parks and greenspaces, might be linked to children's physical activity. In this study, Boone-Heinonen and colleagues investigated the influence of different outdoor spaces on children's leisure-time moderate to vigorous physical activities. Researchers examined outdoor space and physical activity data for over 10,000 7th through 12th grade children from across the U.S. Researchers used a geographic information system (GIS) to examine outdoor spaces around each child's home, including greenspace coverage within 3km of each child's home and distance to the nearest neighborhood park and major park. Researchers also questioned each child regarding their physical activities, including how frequently they participated in specific activities (e.g., baseball, roller-skating, and jogging) during the past week. In analyzing the data, Boone-Heinonen and colleagues found that boys reported more moderate to vigorous physical activity than girls for all activities except exercise. In examining linkages between specific outdoor spaces and children's physical activity, researchers found that children who lived closer to neighborhood and major parks participated in more active sports. Researchers also discovered that girls who lived closer to major parks participated in more wheel-based activity and that girls who lived closer to neighborhood parks were more likely to participate in at least 5 weekly bouts of moderate to vigorous physical activity. With regard to amount of greenspace, Boone-Heinonen and colleagues found that children with more greenspace nearby were more likely to participate in at least 5 weekly bouts of moderate to vigorous physical activity, and that girls with more greenspace nearby participated in more exercise. While this study is cross-sectional and relies on self-reported physical activity data, it provides important information about the role that specific outdoor spaces might play in encouraging children to be physically active and highlights how outdoor spaces might be particularly important for girls.



Author Affiliation: Penny Gordon-Larson is with the University of North Carolina at Chapel Hill.

Boone-Heinonen, J., Casanova, K., Richardson, A. S., & Gordon-Larsen, P. (2010). Where can they play? Outdoor spaces and physical activity among adolescents in US urbanized areas. *Preventive Medicine*. 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/600644/description#description

Focus: Other Benefits

Children's exposure to the outdoors and nature may have other positive influences on their development and well-being, such as through improved school performance and the development of environmental knowledge, attitudes, and behavior. These articles examine other benefits from children's contact with nature.

Research Syntheses:

Adventure playgrounds foster healthy child development

In this article, Staempfi provides an overview of what adventure playgrounds are and the role that they can play in enhancing child development. She discusses the changing nature of children's play, and the history of adventure playgrounds and their recent prominence in many European countries, as well as variations in adventure playground philosophy, structure, and setting. Staempfi highlights the unique role of trained professionals or playworkers at adventure playgrounds that serve as unobtrusive guides to facilitate children's development through play. She also discusses the developmental benefits of adventure playgrounds as well as positive community development outcomes. Staempfi examines the issue of safety and risk on playgrounds and the influence of society's values, beliefs, and legal system in shaping the development of adventure playgrounds. In concluding her article, Staempfi makes a number of recommendations for future research and highlights the importance of educational efforts to build awareness about the developmental benefits of adventure play.

Author Affiliation: Marianne Staempfi 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/>

Original Research:

Elementary school principals overwhelmingly believe recess has a positive impact on students' achievement, learning, and development

Children spend more time in school than almost anywhere else. At school, recess provides one of the few opportunities for children to play and to potentially be outdoors. Gallup conducted a nationwide survey of 1,951 elementary school principals from urban, suburban, and rural schools to understand principals' attitudes and experiences with recess. A few of the key findings include: 1) more than 80% of principals reported that recess has a positive impact on academic achievement; 2) 75% of principals stated that students are more focused in class after recess and listen better; and 3) more than 95% of principals believe that recess positively impacts students' social development and general well-being. Despite these benefits, researchers found that many principals reported offering very limited recess times. For example, 50% of principals reported that students receive 30 minutes or less of recess per day. In addition, over 75% of principals reported taking recess away from students as a punishment. According to principals, one of the biggest challenges with recess is discipline-related problems. Principals identified additional staff, better equipment, and playground management training as ways to improve recess at schools.

Author Affiliation: The poll was conducted by Gallup with sponsorship from the Robert Wood Johnson Foundation and assistance from the National Association of Elementary School Principals and Playworks.

Robert Wood Johnson Foundation. (2010). The state of play: Gallup survey of principals on school recess. This study is available online at:

<http://www.rwjf.org/files/research/stateofplayrecessreportgallup.pdf>

Forest School sessions increase children's and families' play in natural environments and provide numerous benefits

Forest Schools were developed in many European countries, starting in the 1960s, to encourage children to access natural places. In this study, Ridgers and colleagues investigated the impact of Forest School sessions on children's natural play and their families' participation in nature-based activities. To conduct this study, researchers observed, interviewed, and surveyed 17 children, 6 to 7 years of age, before and after they participated in 12 Forest School outdoor sessions that were each 2 hours long at a school in the UK's Mersey Forest. Researchers also interviewed and surveyed 15 parents before and after they participated in a related engagement project, designed to reconnect families to natural play opportunities in the Mersey Forest through organized activities and targeted information. In examining the data, Ridgers and colleagues found that, overall, children increased their natural play and experienced a variety of benefits as a result of the Forest School sessions. Researchers also found that, overall, families participated in more natural play as a result of the Forest School activities. In their reports, researchers discuss many findings, including the following:

- Children's social skills and confidence increased as a result of the Forest School sessions. For example, there was a 7.8% increase in pro-social interactions between children.



- Children engaged in more moderate intensity physical activity following the Forest School sessions.
- Children reported being able to play more on playgrounds and football fields after the Forest School sessions.
- Children increased their knowledge and understanding of the natural environment as a result of their experiences.
- Some parents changed the restrictions they placed on their child's outdoor behavior as a result of their experiences.
- Parents made more of an effort to play in natural environments with their children as a result of their experiences.
- Parents reported seeing positive changes in their children as a result of the Forest School sessions.

While this study may be limited due to the small number of participants and focus on a single Forest School program, very few evaluations of this sort have been completed. This study provides valuable information that can support future research and intervention efforts.

Author Affiliation: Nicola Ridgers is with John Moores University in the UK.

Ridgers, N. D., & Sayers, J. (2010). *Natural play in the forest: Forest school evaluation (Children)*. Natural England. This report may be available from Natural England or The Mersey Forest.

Ridgers, N. D., & Sayers, J. (2010). *Natural play in the forest: Forest school evaluation (Families)*. Natural England. This report may be available from Natural England or The Mersey Forest.

Children's connection to nature influences their interest in participating in nature-based activities and performing environmentally friendly behaviors

Cheng and Monroe developed a new children's connection to nature index and used this index to examine children's connection to nature and factors influencing children's nature-related interests and pro-environmental choices. In developing this new instrument, researchers identified key factors presented in the literature to date regarding people's attitudes towards nature, experiences with nature, and interest in environmentally friendly practices, including sympathy, empathy, interest in nature, experience with nature, and self-efficacy. In addition, Cheng and Monroe conducted interviews with fourth grade students to understand their attitudes toward nature and nature experiences and pilot test index questions. Once the final index was developed, researchers had almost 1,500 fourth-grade students in Brevard County, Florida complete the survey after participating in an environmental education program. In analyzing the data, Cheng and Monroe found that there were 4 main dimensions to children's connection to nature: 1) enjoyment of nature; 2) empathy for creatures; 3) sense of oneness; and 4) sense of responsibility. Cheng and Monroe also developed several models to explore factors that best predict children's interest in participating in nature-based activities and performing environmentally friendly behaviors. In analyzing the data, researchers found that children's connection to nature was the strongest factor in predicting students' interest in participating in nature-based activities, while children's connection to nature,

previous experience with nature, perceived family value toward nature, and their perceived control most strongly influenced their interest in performing environmentally friendly behaviors. Cheng and Monroe discuss the implications of their research in terms of future research needs, as well as the development of environmental education programs. This study may be limited due to its cross-sectional design and focus on a specific age group, however, it provides an encouraging new instrument to predict children's interest in participating in nature-based activities and performing environmentally friendly behaviors.

Author Affiliation: Judith Cheng is with Tamkang University in Taiwan.

Cheng, J. C. H., & Monroe, M. C. (2010). Connection to Nature: Children's Affective Attitude Toward Nature. *Environment and Behavior*. This article may be available in a library near you or can be purchased online through the publisher at: <http://eab.sagepub.com/>

Non-formal outdoor environmental education programs can improve children's environmental orientations

Although there are many environmental education programs, few studies have examined the impact of non-formal (i.e., out-of-school) outdoor environmental education programs on children's environmental orientations. Larson and colleagues conducted an exploratory study to investigate differences in children's environmental orientations in terms of gender, age, and ethnicity, as well as to evaluate the impacts of a one-week, non-formal outdoor environmental education program on children's environmental orientations. As part of this study, 133 6- to 13-year-old children in Athens-Clarke County, Georgia participated in a five-day Eco-Explorer Camp, while another group of 69 students participated in traditional after-school programs. Researchers measured children's environmental orientations, including eco-affinity (personal interest in nature and intention to engage in pro-environmental behavior) and eco-awareness (cognitive understanding of environmental issues), as well as environmental knowledge prior to and after the camp/after school program. In addition, researchers gathered more qualitative data on children's camp experiences through interviews and evaluations. In analyzing the data in terms of gender, age, and ethnicity, Larson and colleagues found no gender differences in terms of children's environmental orientations, however, researchers found that older children had lower eco-affinity levels than younger children and African-American children had lower eco-awareness and environmental knowledge scores than White children. In analyzing the data in terms of the impact of the environmental education program, Larson and colleagues found that after the program children scored significantly higher in terms of eco-affinity and environmental knowledge across all gender, age, and ethnicity groups, however, the program did not impact children's eco-awareness. In talking with children about their camp experiences, researchers discovered that children preferred activities that involved physical activity and "having fun" was a critical component. Researchers also found interesting ethnicity differences, such as that White children were more than twice as likely to report engaging in solitary nature-based activities than African American children. While this study may be limited due to its small sample size and inability to control for numerous differences between camp

and after school groups, this study provides valuable insight into the potential positive impacts of a non-formal outdoor environmental education program on children's environmental orientations.

Author Affiliation: Lincoln Larson is with the University of Georgia.

Larson, L. R., Castleberry, S. B., & Green, G. T. (2010). Effects of an Environmental Education Program on the Environmental Orientations of Children from Different Gender, Age, and Ethnic Groups. *Journal of Park and Recreation Administration*, 28(3), 95-113. This article may be available in a library near you or can be purchased online through the publisher at: <http://journals.sagamorepub.com/ebooks/>

Direct nature experiences are important for changing environmental attitudes & behavior

Many environmental education programs strive to positively influence children's environmental behavior, however, we currently know very little about program elements and experiences that lead to changes in environmental behavior. In this study, Duerden and colleagues investigated the relationship between indirect and direct nature experiences and children's environmental knowledge, attitudes, and behavior. Researchers used surveys, focus groups, and observations to evaluate the experiences of 108 middle and high school students that participated in an international immersion environmental education program, which included a preparatory program (indirect nature experience), a 7-14 day international field workshop (direct nature experience), and a post-trip service project. Duerden and colleagues surveyed participants at multiple stages in the program, as well as a comparison group of 49 middle and high school students who did not participate in the program. In analyzing the data, researchers found that program participants had a significant increase in environmental knowledge as compared to the comparison group. In examining the impact of different program components, Duerden and colleagues found that during the indirect nature experience (i.e., the preparatory program) children's environmental knowledge increased more than their environmental attitudes and environmental attitudes had a stronger impact on children's environmental behavior, while during the direct nature experience (i.e., the international workshop) both children's environmental knowledge and attitudes developed rather equally and both environmental knowledge and attitudes were related to environmental behavior. In addition, researchers discovered that while children's indirect experiences led to enhanced environmental knowledge, it was their direct experiences that led to attitude and behavior development. Interestingly, Duerden and colleagues found that the nature of children's direct experience was vital to the impact it had on children. For example, researchers discovered that children perceived experiences to be more direct if they were afforded freedom and autonomy during the experience. While this study may be limited due to its small sample size, reliance on self-report data, and environmental program variability, the researchers' study design and mix of methods provides an important contribution to the literature. In concluding their article, Duerden and colleagues highlight program implications from their research, as well as future research needs.

Author Affiliation: Mat Duerden is with Texas A&M University.

Duerden, M. D., & Witt, P. A. (2010). The impact of direct and indirect experiences on the development of environmental knowledge, attitudes, and behavior. *Journal of Environmental Psychology*(April 3). This article may be available in a library near you or can be purchased online through the publisher at: <http://www.elsevier.com/>

Update: Children's experience of nature

This section reviews research from 2009-2011 focused on children's experience of nature. While some studies document children's experience of nature directly, this section also highlights studies on related factors that provide insight on this topic. Research is grouped into several main focal areas.

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, nature contact, and influencing factors.

Original Research:

In the past 5 years, children's media use has increased substantially

In this report, Rideout and colleagues discuss the results of one of the largest and most comprehensive studies on American children's media use. The Kaiser Family Foundation has conducted this study 3 times: in 1999, 2004, and 2009. For their 2009 study, more than 2,000 children between 8 and 18 years of age completed a survey regarding their media-related activities, including watching television and movies, playing video games, listening to music, using computers, and reading newspapers, magazines, and books. In addition, about 700 of these children completed seven-day media use diaries. In their report, Rideout and colleagues present many interesting findings, including the following:

- From 2004 to 2009, children's media use increased substantially. In 2004, children spent an average of almost 6.21 hours with media daily, whereas children in 2009 spent an average of 7.38 hours daily with media.
- When multitasking is taken into account (time spent using more than one form of media at a time), children in 2009 packed nearly 11 hours of media exposure each day into 7.38 hours, an increase of almost 2.25 hours over 2004 levels.
- Children in 2009 spent more time with every type of media, except for reading, as compared to 2004. For example, children spent an average of 38 minutes more watching TV a day and 47 minutes more a day with music and other audio than they did in 2004.

- Mobile and online media has facilitated children's increasing media use. For example, 66% of children in 2009 had their own cell phone, as compared to 39% in 2004, and 76% had an iPod or other MP3 player, as compared to 18% in 2004.
- How children use media has also changed. For example, cell phones are no longer used just for talking, they are used for listening to music, playing games, and watching TV.
- Children who spend more time with media report that they receive lower grades and are more likely to report that they are often sad or unhappy as compared to children who spend less time with media.
- Media use does not seem to impact children's physical activity. Children who spend more time with media reported spending similar amounts of time being physically active as children who spend less time with media.
- Children who have parents that limit their media use (e.g., do not put a TV in their bedroom) spend less time with media.
- 11- to 14-year-old children experience a huge increase in media use as compared to 8- to 10-year-olds. For example, 8- to 10-year-olds spend an average of 5 hours and 29 minutes with media, while 11- to 14-year-olds spend an average of 8 hours and 40 minutes with media.
- Hispanic and Black children spend more time than White children with media (about 13 hours a day as compared to 8.5 hours a day).

This report provides valuable information for parents, researchers, and policymakers interested in children's media use and health and well-being.

Author Affiliation: Victoria Rideout is with the Kaiser Family Foundation.

Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). *Generation M2: Media in the lives of 8- to 18-year-olds*. Kaiser Family Foundation. This report is available online at:
<http://www.kff.org/entmedia/entmedia030905pkg.cfm>

In one generation, there has been a huge decline in Australian children's outdoor play

In 2011, Planet Ark, a not-for-profit environmental organization, commissioned a study to examine childhood interaction with nature today as compared to a generation ago. Over 1,000 Australians between 14 and 65 years of age completed an online survey. In analyzing the data, researchers found many interesting results, including the following:

- *There has been a huge decline in children's outdoor play.* For example, 73% of respondents reported playing outdoors more often than indoors when they were young as compared to only 13% of their children. They also found that 1 in 10 children today play outside once a week or less.
- *The nature of children's outdoor play has changed.* For example, 64% of respondents reported climbing trees when they were children as compared to less than 20% of their children.
- *Respondents believe in the benefits of outdoor play.* For example, 93% of respondents agreed that outdoor play helps children develop physical and motor skills.

- *There are a number of barriers (perceived and real) that impact children's outdoor play.* For example, 33% of respondents reported that crime and safety concerns are a barrier to their child's outdoor play as compared to 9% who reported that crime and safety concerns were a barrier when they were young.
- *Routine opportunities for outdoor play have declined, such as walking or bicycling to school.* For example, 75% of respondents reported that they lived close enough to walk or bike to school when they were children, as compared to just 37% of children today.

In addition to detailing the findings of the survey, the authors discuss similarities between this study and a similar study that was conducted in the U.S. in 2004. The authors also discuss the benefits for children of spending time outside and provide a list of resources for individuals interested in increasing the amount of time children spend outside. While this study may be limited due to its reliance on self-reported information and adult memories of childhood, this survey provides valuable information about children's outdoor behavior in Australia.

Author Affiliation: The authors are with Planet Ark in Australia.

Planet Ark. (2011). Climbing trees: Getting Aussie kids back outdoors. This report is available online at: <http://treeday.planetark.org/about/health-benefits.cfm>

In three generations, there has been a significant decline in the amount of time Danish children spend in nature

The Danish Society for Nature Conservation had TNS Gallup conduct a poll to investigate how three different generations of Danes experienced nature. As part of this poll, a representative sample of 1,000 parents of 5- to 12- year-old children and 1,000 adults between 55 and 70 years of age (the grandparent generation) answered a series of questions about their or their children/grandchildren's use of natural space and attitudes toward nature. In this report, Paltved-Kaznelson presents many interesting findings, including the following:

- In three generations, there has been a significant decline in the amount of time that children spend in nature. For example, 59% of grandparents reported visiting a natural setting every day during the summer when they were children, as compared to 42% of parents and just 26% of children today.
- The level of engagement in organized sports has increased significantly. For example, 22% of grandparents reported participating in organized sports several times a week when they were children, compared to 38% of parents and 44% of children today.
- 73% of grandparents and 54% of parents reported that children do not spend enough time in nature.
- 81% of grandparents and 67% of parents reported that electronic media (TV, computers, electronic games) is the most important reason why children spend less time outside than in previous generations. In addition, 44% of parents believe that "parents not taking time to let their children experience nature" is an important reason why children do not spend as much time outdoors.



- In general, parents agreed that childhood experiences in nature had a positive influence on their lives and that a childhood with nature experiences is better than one with few or no nature experiences.
- The majority of parents agreed that it is important for their children to learn about nature and that it is healthy for children to spend time in nature.

While this study may be limited due to its reliance on self-reported information and adult memories of childhood, it provides valuable information about children's outdoor behavior over three generations in Denmark.

Author Affiliation: Celia Paltved-Kaznelson is with The Danish Society for Nature Conservation.

Paltved-Kaznelson. (2009). *Nature through the generations*. The Danish Society for Nature Conservation. This report may be available through The Danish Society for Nature Conservation.

Youth participation in outdoor activities has declined since 2006

For the past three years, The Outdoor Foundation has conducted a nationwide survey to examine youth participation in outdoor recreation. In 2009, The Outdoor Foundation conducted a nationwide survey of over 41,000 individuals between the ages of 6 and 25. Respondents under the age of 13 completed the survey with a parent, while respondents over the age of 13 completed the survey themselves. In their report, The Outdoor Foundation outlines a number of key findings, including the following:

- 59% of 6- to 24 year-olds participated in outdoor recreation (defined as having taken part in one or more of 40 activities at least once during 2008).
- Youth participants made up 34% of all outdoor recreation participants. Participation in outdoor recreation was highest among 6- to 12-year-olds at 64%, declined to 61% for 13- to 17-year-olds, and declined further to 54% for 18- to 24-year-olds.
- Youth participation in outdoor recreation declined since 2006 in all age groups and among both boys and girls. The rate of decline was greatest among 6- to 12-year-old girls (77% in 2006 versus 58% in 2008).
- More males participated in outdoor recreation than females (56% versus 44%).
- More Caucasians participated in outdoor recreation than other ethnic populations (79% versus 7.4% for African Americans).
- Running, bicycling, and freshwater fishing were the most popular outdoor activities among youth.
- Parents, friends, and family were the strongest influences in getting younger children to participate in outdoor recreation.
- 46% of youth reported that lack of time and interest kept them from participating in outdoor activities more often.
- Youth with nearby walking and biking routes participated in more outdoor recreation (21% more for walking routes and 25% more for biking routes).



This nationwide survey provides important information about trends in and characteristics of youth outdoor recreation, which can help inform research, policy, and programs focused on enhancing children's outdoor experiences.

Author Affiliation: The Outdoor Foundation is located in Boulder, Colorado.

The Outdoor Foundation. (2010). *Special report on youth: The next generation of outdoor champions*. Boulder. This report is available online at:
<http://www.outdoorfoundation.org/pdf/ResearchYouth.pdf>

In the UK, children's ability to play in their local community has declined

Playday is an annual celebration of children's right to play. In 2010, Playday's annual theme was *Our Place!*, which focused on children's play experiences in their communities. To support this theme, Play England conducted a literature review, a qualitative study, and an opinion poll related to community-based play. In the literature review, Gleave discusses evidence related to the benefits of community play, children's use of community spaces, and attitudes towards children's use of community spaces. With regard to the research components, ICM research surveyed a random sample of over 1,000 adults and 1,000 children, aged 7 to 14, from across the UK regarding children's community play. In addition, Play England conducted a series of seven focus groups across the UK with children, parents, and adults to gather additional information on children's community play. In their reports, the authors discuss many interesting findings, including the following:

- Compared to the previous generation, children today have fewer friends they can play with in their neighborhood. Adults reported having an average of 14 friends when they were children, compared to an average of just 6 friends for children today.
- 79% of adults reported that they believe community spirit has declined since they were children.
- Children's ability to play outside is limited due to safety concerns. For example, 49% of adults reported that they do not let their children play outside without an adult. The biggest concern for parents was road accidents.
- 55% of parents reported that they are concerned that their neighbors might get upset if their children make noise outside.
- Children are often negatively judged by adults. For example, 24% of children reported that they have been scolded for playing ball games in their neighborhood.
- People are hesitant to get involved with children in the community. For example, 44% of men reported that they would be concerned about approaching a child who needed help because others might think they were trying to abduct the child.
- People recognize the benefits of children playing outside for their community. For example, 88% of parents reported that they believe that children playing outside helps community members get to know each other.

While this research may be limited due to its reliance on self-reported information and adult memories of childhood, it provides valuable information about children's community play in the UK. As part of this research effort, report authors also present a range of solutions to help encourage more play in local neighborhoods.

Author Affiliation: ICM research conducted the opinion poll on behalf of Play England. Josie Gleave conducted the literature review and wrote the report on the focus group research. Josie Gleave is with Play England.

Playday. Playday 2010 opinion poll survey.

Gleave, J. (2010). *Making it our place: Community views on children's play*. Play England.

Gleave, J. (2010). *Community play: A literature review*. Play England.

These reports are available online at: http://www.playday.org.uk/playday_campaigns/2010_theme.aspx

Norwegian children's play in natural spaces today is significantly different than the previous generation

Skår and Krogh investigated changes in children's outdoor play and use of natural areas in Brummunddal, a semi-urban community in Norway that has good access to a variety of natural areas. Researchers interviewed 20 residents between the ages of 18 and 72 about their experiences as children as well as their observations about children's experiences today. In analyzing the interview data, Skår and Krogh found that children's use of natural areas has changed from being self-initiated to being more planned and organized, as well being more time-limited and controlled by adult activities. The researchers found that children's geographical range used to be determined more by age and physical ability, but is now dependent on parental transport. In addition, Skår and Krogh found that social norms regarding children playing alone outside and the importance placed on participating in structured activities have changed. Participants highlighted the changing social dimension of children's play, from large groups of children that played outdoors in the past to small groups of children that play indoors today. Participants also noted changes in physical and social barriers, including increased train and road traffic and social fear. Skår and Krogh note that these findings are particularly significant given that they have occurred in a semi-urban area with good access to nature and in a country that is 40% wooded and that has a strong tradition of associations with nature. While this research may be limited due to its small sample size, reliance on self-reported information, and adult memories of childhood, it provides important information on shifting childhood experiences with nearby nature in Norway.

Author Affiliation: Margrete Skår is with the University of Life Sciences and Norwegian Institute for Nature Research in Norway.

Skar, M., & Krogh, E. (2009). *Changes in children's nature-based experiences near home: from spontaneous play to adult-controlled, planned and organised activities*. *Children's Geographies*, 7(3).

This study may be available in a library near you or can be purchased online through the publisher at: <http://www.tandf.co.uk/journals/titles/14733285.asp>

Rural and metropolitan children have different place experiences

MacDougall and colleagues investigated metropolitan and rural children's perspectives on where they live and the boundaries that guide their activities. Researchers interviewed 33 8- to 10-year-old children from Adelaide, the capital of South Australia and Kangaroo Island, off the South Australian coast. Children also drew maps or pictures about places and activities they discussed during their interviews and took photos using a disposable camera of places they played, people they played with, and what they did. In analyzing the data, MacDougall and colleagues found that metropolitan and rural children had very different place experiences. Researchers found that metropolitan children enjoyed gardens, parks, and playgrounds and organized activities, whereas rural children enjoyed large open spaces, the natural world, and freedom to explore the natural environment. In terms of negative aspects of their communities, MacDougall and colleagues discovered that rural children mentioned dangers from animals and water, as well as distance and traffic problems in getting places, whereas metropolitan children mentioned factories, safety, and danger. With regard to boundaries, researchers found that metropolitan children had tighter boundaries and required more adult supervision as compared to rural children, but that rural children relied heavily on adults to travel between distant locations. In addition, MacDougall and colleagues discovered that rural children negotiated with their parents about places they could go and most of the concerns were about managing safety and risks in the natural environment, whereas metropolitan children's movements were determined by their parents and often revolved around concerns about traffic and danger from people. Importantly, the researchers highlight the fact that children from both areas enjoyed their environments and experiences. This study may be limited due to its small sample size and reliance on self-reported information, however, it demonstrates the importance of context and taking children's own views into account when designing places and programs.

Author Affiliation: Colin MacDougall is with Flinders University in Australia.

MacDougall, C., Schiller, W., & Darbyshire, P. (2010). What are the boundaries and where can we play? Perspectives from eight- to ten-year-old Australian metropolitan and rural children. *Early Child Development and Care, 179*(2). This study may be available in a library near you or can be purchased online through the publisher at: <http://www.tandf.co.uk/journals/titles/03004430.asp>

Girls' and boys' active play outdoors differs in terms of activities, location, and social context

Active play—unstructured physical activity that takes place outdoors in a child's free time—may be an important contributor to children's overall physical activity levels, as well as children's physical and mental health. In this study, Brockman and colleagues investigated children's perceptions of play, engagement in active play, the contexts of children's active play, and factors that limit and facilitate active play. Researchers interviewed, in small focus groups, 77 10- to 11-year old children

from four primary schools in Bristol, UK. In analyzing the data in terms of major themes, Brockman and colleagues reported a number of interesting findings, including the following:

- Children reported that they took part in active play for enjoyment, to prevent boredom, for physical and mental health benefits, and for freedom from adult control.
- Children's activities during active play varied by gender. Active play for boys often involved specific activities, such as riding bikes or playing ball games, while active play for girls involved less specific activities, such as playing outside with friends or pets.
- Where children engaged in active play also varied by gender. Girls' active play generally happened closer to home, whereas boys' active play tended to happen in neighborhood green spaces or the streets.
- Who children engaged in active play with varied by gender. Boys most often reported engaging in active play with neighborhood friends, while girls engaged in active play with family members.
- Children reported that their active play was constrained by several factors, including rainy weather and the presence of groups of older children, especially for girls.
- Children mentioned using cul-de-sacs and green spaces as places to play.
- Children reported that using a mobile phone to communicate with their parents while out of the house facilitated their ability to engage in active play.

While this study may be limited due to its small sample size and focused geographic context, it provides valuable information on a topic that has received little attention to date. This study highlights children's active play from children's perspective and demonstrates important gender differences in active play, as well as factors that facilitate/limit children's active play.

Author Affiliation: Rowan Brockman is with the University of Bristol in the UK.

Brockman, R., Fox, K. R., & Jago, R. (2011). What is the meaning and nature of active play for today's children in the UK? *The International Journal of Behavioral Nutrition and Physical Activity*, 8(15). This study may be available in a library near you or can be purchased online through the publisher at: <http://www.ijbnpa.org/>

Brockman, R., Jago, R., & Fox, K. (2011). Children's active play: self-reported motivators, barriers and facilitators. *Bmc Public Health*, 11(1), 461. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.biomedcentral.com/bmcpublichealth/>

Individual and social factors impact the amount of time children spend outdoors

Physical activity is important for good health, however, little is known about the specific settings where physical activity takes place. In this study, Cleland and colleagues investigated individual, social, and physical environmental influences on children's outdoor time over a period of 5 years. Over 400 children aged 5 to 6 and 10 to 12, from elementary schools in Melbourne, Australia, participated in the study. Parents completed surveys about the amount of time their child spent outside, as well as surveys on a range of individual (e.g., outdoor and indoor tendencies), social (e.g., rules and restrictions and parental encouragement), and environmental factors (e.g., yard size and

number of destinations within walking distance). In analyzing the data, Cleland and colleagues found that children's time spent outdoors significantly declined over time among younger and older boys and older girls. When examining predictors of children's time spent outdoors over the 5 years, researchers found the following:

- Younger boys who had higher "indoor tendencies" spent less time outdoors, while younger boys with a lot of social opportunities spent more time outdoors.
- Older boys who had higher "indoor tendencies" spent less time outdoors, while older boys with higher "outdoor tendencies" spent more time outdoors. In addition, they found that older boys who did not have adult supervision spent less time outdoors.
- Younger girls who had higher "indoor tendencies" spent less time outdoors, while younger girls who received a lot of parental encouragement spent more time outdoors.
- Older girls who did not have adult supervision spent less time outdoors, while older girls who received a lot of parental encouragement spent more time outdoors.

Cleland and colleagues found a number of individual and social factors that were related to changes in children's time spent outdoors over the 5 year period. The researchers, however, did not find any evidence of linkages between physical environmental factors and children's time spent outdoors. While this study relied on self-report measures, its longitudinal design and emphasis on a range of factors help advance our understanding about children's time outdoors. This study demonstrates the importance of individual and social factors in the amount of time children spend outside, which can help inform future research and intervention efforts.

Author Affiliation: Verity Cleland is with Deakin University in Australia.

Cleland, V., Timperio, A., Salmon, J., Hume, C., Baur, L. A., & Crawford, D. (2010). Predictors of time spent outdoors among children: 5-year longitudinal findings. *Journal of Epidemiology and Community Health*, 64(5), 400-406. This study may be available in a library near you or can be purchased online through the publisher at: <http://jech.bmj.com/>

Road characteristics impact the amount of time children spend outside

Bringolf-Isler and colleagues investigated the effects of socio-cultural and environmental factors, both from parents' perceptions and from objectively assessed characteristics, on children's vigorous outdoor play. The study was conducted with 6- to 7-, 9- to 10-, and 13- to 14-year-old children from three urban or rural communities in Switzerland that were French and/or German speaking. Parents completed surveys about the amount of time their child spent playing outdoors, various demographic characteristics, and environmental characteristics of their neighborhood. In addition, researchers used a geographic information system (GIS) to examine various environmental characteristics around each child's home, such as street density and amount of green space. In analyzing the data, Bringolf-Isler and colleagues found that younger children spent an average of about 82 minutes a day playing outside, while older children spent an average of 42 minutes a day playing outside. The researchers also found that girls, older children, and children with a French speaking background spent less time vigorously playing outdoors, while children who were non-Swiss and had younger siblings spent more time playing outside. With regard to environmental

factors, Bringolf-Isler and colleagues found that children spent less time playing outdoors if they lived in an area with higher street density. In addition, the researchers found that younger children in urbanized areas spent less time playing outdoors if their parents were concerned about traffic safety. This study may be limited due to its cross-sectional design and thus cannot examine causation, however, the researchers' examination of a broad range of factors, use of both objective (GIS) and subjective (parent surveys) assessment measures, and focus on Europe provides a valuable contribution to the literature in this area. Overall, this study highlights the importance of road characteristics in terms of children's physical activity.

Author Affiliation: Bettina Bringolf-Isler, is with the Swiss Tropical and Public Health Institute in Switzerland.

Bringolf-Isler, B., Grize, L., Mader, U., Ruch, N., Sennhauser, F. H., & Braun-Fahrlander, C. (2010). Built environment, parents' perception, and children's vigorous outdoor play. *Preventive Medicine, 50*(5-6), 251-256. 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/600644/description#description

The neighborhood environment influences children's active free-play outdoors

Active free-play outdoors may serve as an important way to increase children's physical activity levels. In this study, Veitch and colleagues investigated the relationship between various individual, social, and environmental factors and children's active free-play in three locations outside of school hours: the yard at home, in their street/court/footpath, and the park/playground. Researchers also examined relationships between how often children played in these three locations and their physical activity levels. As part of this study, 187 parents of 8- to 9-year-old children from primary schools in Melbourne, Australia completed a survey about individual factors (e.g., marital and employment status), social environmental factors (e.g., crime rate in neighborhood), and physical environmental factors (e.g., size of yard and quality of parks). In addition, participating children wore an accelerometer for 8 days to measure their physical activity levels. In analyzing the data, Veitch and colleagues found the following results for each of the three locations examined:

- *Yard at Home:* Parents reported that their child played most often in this location. Children were more likely to play in their yard if their parents reported a high crime rate in their neighborhood. Children who preferred activities not involving physical activity were less likely to play in their yard.
- *Street/Court/Footpath:* Children were more likely to play in their street/court/footpath if their parents reported that the neighborhood was safe, they lived in a cul-de-sac, and that their child had many friends in their neighborhood.
- *Park/Playground:* Children were more likely to play in the park/playground if their parents reported that the family went to the park together on a regular basis.

As part of their analysis, Veitch and colleagues found no relationship between how frequently children played in these locations and their physical activity levels. While this study may be limited due to its use of parent reports and its cross-sectional design, it suggests important avenues for



future research as well as opportunities to increase children's active free-play, such as by enhancing social neighborhood networks and improving knowledge about neighborhood safety.

Author Affiliation: Jenny Veitch is with Deakin University in Australia.

Veitch, J., Salmon, J., & Ball, K. (2010). Individual, social and physical environmental correlates of children's active free-play: a cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity*, 7. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.ijbnpa.org/>

Neighborhood social cohesion positively impacts children's outdoor play

Aarts and colleagues examined physical and social factors that influence children's outdoor play in the home and neighborhood environment. Researchers surveyed over 6,000 parents of 4- to 12-year-old children in four Dutch cities. In analyzing the data, Aarts and colleagues found that several personal/home characteristics were positively associated with children's outdoor play, including the importance parents place on outdoor play and the presence of electronic devices in the child's room, while parental education was negatively associated with children's outdoor play. In examining neighborhood factors, researchers found that neighborhood social cohesion was positively associated with children's outdoor play. With regard to physical neighborhood factors, however, Aarts and colleagues discovered no consistent relationships: the relationships varied depending on the age and gender of the children. For example, the presence of water was positively associated with outdoor play for 4- to 6-year-old boys, but not for girls or boys of other ages. While this study is cross-sectional in nature and relied on self-reported information, it provides a valuable perspective on factors influencing children's outdoor play. This study suggests that neighborhood social cohesion may be a particularly important characteristic to focus on in order to improve children's outdoor play and that efforts focusing on the physical environment should take into account the age and gender of the children impacted.

Author Affiliation: Marie-Jeanne Aarts is with Tilburg University in The Netherlands.

Aarts, M. J., Wendel-Vos, W., van Oers, H. A. M., van de Goor, I. A. M., & Schuit, A. J. (2010). Environmental Determinants of Outdoor Play in Children: A Large-Scale Cross-Sectional Study. *American Journal of Preventive Medicine*, 39(3), 212-219. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.ajpmonline.org/>

Americans believe nature experiences are important for children, but face a number of barriers that limit their ability to support children's nature contact

In a study commissioned by the Children & Nature Network, Fraser and colleagues surveyed over 2,000 Americans about their attitudes towards children's nature experiences. To assess attitudes, researchers developed a scale that examined 4 areas: 1) what adults believe children gain from their experiences with nature; 2) the degree to which adults prioritize nature experiences and the impact that risks have on adult encouragement; 3) the belief that adult behaviors will influence children's



nature experiences; and 4) commitment to participate in activities that increase children's nature experiences. In analyzing the survey data, Fraser and colleagues found many interesting results, including the following:

- In general, adults believe that nature experiences benefit children, in particular their physical development, socialization, and appreciation of nature.
- Adults report that they personally plan on supporting children's nature experiences, however, they do not model important behaviors, such as personal storytelling or mentoring behavior based on their own nature experiences.
- Adults are very concerned about children's safety. Adults are particularly concerned about risks associated with streams and ponds, woods, open fields, and mountains.
- Many adults believe that nature is far from their home and difficult to access.
- Americans with lower education levels and lower incomes show less support for the value of children's nature experiences than those of higher education and income levels.
- American Indian/First Nations peoples and older Americans more strongly support the value of children's nature experiences.

Based on their findings, Fraser and colleagues provide a series of recommendations to help minimize barriers and enhance children's nature experiences, such as improving information and communication about the importance of close-by nature experiences and mentoring activities. This survey provides important information about American attitudes toward children's nature experiences and will serve as a valuable instrument to track changes over time.

Author Affiliation: John Fraser is with the Institute for Learning Innovation in Maryland.

Fraser, J., Heimlich, J., & Yocco, V. (2010). Report Number 20100226: *American beliefs associated with encouraging children's nature experience opportunities*. Edgewater, MD: Institute for Learning Innovation. This report can be found online at:
http://www.childrenandnature.org/downloads/EC-NES_Final_Report_2010.pdf

California children want to engage in more outdoor activities, but face a number of constraints

Goldenberg and colleagues investigated California children's outdoor recreation attitudes, behaviors, and constraints. Researchers held eight focus groups with a total of 72 10- to 17-year-old children from community recreation centers in four large cities within different geographical regions in California. Goldenberg and colleagues asked children ten questions about their outdoor recreation experiences. In analyzing the interview data in terms of dominant themes, researchers found many interesting results, including the following:

- Children mentioned a variety of activities that they participated in outdoors, including skateboarding, camping, swimming, hiking, football, soccer, and biking.
- On an average day, children reported spending a median of 3 to 4 hours outside.
- 81% of children said that they would like to spend more time outside.



- Children reported that they would like to try a variety of outdoor activities, including rock climbing, snowboarding, skydiving, ice hockey, and bungee jumping.
- Children mentioned that what they most liked about being outside was having fun/enjoyment, experiencing new places/things, and relaxing.
- Children reported that what they liked least about being outside was the weather and safety concerns.
- Children mentioned that family influence, school/homework, and technology/electronics most often keep them from spending time outside.
- Children reported wanting more amenities at parks and safety improvements.
- Children highlighted the importance of family members and club/camp/center programs in facilitating their participation in outdoor activities.

This study may be limited due to its small sample size, reliance on self-reported information, and focus on children from specific geographic areas, however, it provides valuable information, from the perspective of children, to help inform future research efforts, as well as program and park development efforts.

Author Affiliation: Marni Goldenberg is with California Polytechnic State University.

Goldenberg, M., Wassenberg, K., Greenwood, J., Hendricks, W., Jacobs, J., & Cummings, J. (2010). A Qualitative Investigation of Californian Youth Interests in the Outdoors. *Journal of Youth Development*, 5(1), 31. This report is available online at:

http://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1001&context=rpta_fac&sei-redir=1#search=%22qualitative%20investigation%20californian%20youth%20interests%20outdoors%22

A variety of factors influence American children's connection with nature

In 2011, The Nature Conservancy commissioned a nationwide poll of American children to understand children's connection with nature. The polling team conducted on-line interviews with a diverse and representative sample of 602 children between the ages of 13 to 17. Survey questions explored children's current connection with nature, environmental attitudes, and obstacles and opportunities to connect with nature. The survey report highlights many interesting findings, a few of which include:

- Children spend a lot of time engaged in electronic media. For example, 88% of children reported using a computer almost every day, while only 11% of children reported visiting a local park or natural area almost every day.
- Obese children prefer indoor activities more than children who are not obese and are less likely to have had a meaningful experience in nature.
- 66% of children reported having a meaningful experience in nature.
- Children who have had a meaningful experience in nature are more likely to prefer spending time outdoors, express concern about environmental issues, consider themselves a strong environmentalist, and express interest in studying the environment or pursuing an environmental career.



- Children most often experience nature with friends (79%), followed by parents (46%) and brothers and sisters (44%).
- Children reported that feelings of discomfort (bugs, heat, etc.), lack of transportation to natural areas, and lack of natural areas near home were the top 3 reasons why they did not spend more time in nature.
- Children living in the West are most likely to prefer spending time outdoors, while children living in the Northeast are most likely to prefer spending time indoors.
- 86% of children said that it is “cool” to do things that protect the environment.

Based on the survey results, researchers highlight a number of strategies to enhance children’s connection to nature, including providing opportunities at school that engage children with nature, getting friends and parents to encourage children to spend more time outside, and ensuring that activities are fun and easy.

Author Affiliation: This report was produced by The Nature Conservancy, a nonprofit conservation organization based in Arlington, VA.

The Nature Conservancy. (2011). *Connecting America's youth to nature*. This report is available online at: <http://www.nature.org/newsfeatures/kids-in-nature/youth-and-nature-poll-results.pdf>

Children’s risk-taking behavior during outdoor play is influenced by their parents’ risk-taking beliefs

Appropriately responding to risk situations is a result of a child’s direct experiences, as well as the guidance he or she receives. In this study, Little investigated factors that might contribute to parental strategies in guiding children in risk-taking behavior. Specifically, she examined the relationship between parents own risk-taking behaviors and beliefs and how they respond to their child’s risk-taking behavior during outdoor play. As part of this study, Little interviewed 26 parents of 4- to 5-year-old children from early childhood centers in different parts of Sydney, Australia and had parents complete a questionnaire about their risk-taking beliefs and behaviors. She also observed 12 of these parents interacting with their child for 20 minutes during play at a local playground to document children’s risk-taking behavior and parent verbal and physical responses. In analyzing the interview and survey data, Little found that 87% of parents recognized the importance of risk-taking and its positive impacts on learning and development. In addition, she found that 73% of parents believed risk-taking helped promote skill development, 51% believed it helped build confidence, and 38% believed it helped children learn how to avoid injury. In examining the observational data, Little found that children mainly engaged in lower level risk behaviors and that parents predominantly supervised their child’s play passively and provided encouragement, instructions, physical support, and modeling to support their child’s play, rarely intervening to prevent risky play. While the researcher could not conduct statistical comparisons between boys and girls, she did observe gender differences in children’s risk-taking behavior. For example, she found that girls tended to show greater apprehension in engaging in activities beyond their current skill level. With regard to the relationship between parents’ own risk-taking behaviors and beliefs and their response to risk-taking behavior, Little discovered that there was a significant relationship: children who engaged in higher

risk behaviors had parents with higher total risk beliefs and behaviors. In the article, she discusses three possible explanations for this relationship. Although this study has a small sample size and may be limited due to its focus on self-reported and observational data, it provides important information about the influence of parent beliefs about risk and safety on children's risk-taking behavior.

Author Affiliation: Helen Little is with Macquarie University in Australia.

Little, H. (2010). Relationship between parents' beliefs and their responses to children's risk-taking behaviour during outdoor play. *Journal of Early Childhood Research, 8(3), 315.* This study may be available in a library near you or can be purchased online through the publisher at: <http://ecr.sagepub.com/>

Hunting, shooting, and fishing programs play an important role in maintaining and increasing interest in these outdoor activities

It is estimated that there are more than 400 national and statewide hunting, shooting, and fishing recruitment and retention programs for youth and adults, however, there have been no comprehensive evaluation efforts undertaken to understand program effectiveness. In this study, researchers investigated the impact of 37 diverse hunting, shooting, and fishing programs on participation in and participant attitudes toward hunting, sport shooting, and fishing. Thousands of youth and adult participants from a representative sample of 37 state and national hunting, shooting, and fishing programs completed pre- and post-program surveys and participated in telephone interviews. In their report, researchers discuss program impacts in great detail, including pre- and post-program results for each program, as well as top-rated programs for achieving certain end results, such as increasing self-identification as a hunter, shooter, or angler. In addition, the researchers provide a summary of their major findings, including the following:

- Programs are generally more effective at retaining people already initiated into hunting, shooting, and fishing than they are at recruiting new people to these activities.
- Programs generally have a positive impact on participants thinking of themselves as hunters, shooters, and anglers.
- Most participants' interest in hunting, shooting, or fishing remained the same or increased after program participation. Youth participants in particular seemed to have increased interest after program participation.
- Most participants' hunting, shooting, or fishing activity increased or remained the same after program participation.
- Most youth participants said that they learned a lot from program participation.
- Participants were generally highly satisfied with the overall program they participated in, as well as individual program elements.
- Most participants were interested in enrolling in other hunting, shooting, or fishing programs in the future.



In addition to discussing major findings, researchers provide a number of recommendations to help organizations improve existing programs and develop new programs to increase participation in hunting, sport shooting, and fishing.

Author Affiliation: Responsive Management is based in Virginia and is a public opinion and attitude survey research firm. The National Wild Turkey Federation is based in South Carolina and is a nonprofit organization dedicated to conserving the wild turkey and preserving our hunting heritage.

Responsive Management & National Wild Turkey Federation. (2011). *Effectiveness of hunting, shooting, and fishing recruitment and retention programs: Final report.* This report is available online at: http://www.responsivemanagement.com/download/reports/R&R_Evaluation_Report.pdf

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.

Original Research:

Different factors attract different groups of children to parks

Parks may play an important role in supporting children's physical activity, however, little is known about specific park characteristics that facilitate children's park use. In this study, Loukaitou-Sideris and Sideris investigated the relationship between specific park characteristics and children's park use, as well as how park use differs between boys and girls, children of different racial and ethnic backgrounds, and between inner-city and suburban children. To conduct this study, researchers surveyed hundreds of middle-school children and parents in the suburban San Fernando valley region of Los Angeles and the Los Angeles inner city. In addition, researchers visited 100 parks and their surrounding neighborhoods (50 in the inner city and 50 in the suburban valley region), documenting park use on weekdays and weekends, as well as park attributes. In analyzing the data, Loukaitou-Sideris and Sideris found many interesting results, including the following:

- *Parks are underutilized.* Nearly half of all children reported going to a park twice per week or more, however, 20% of children said that they did not use parks at all. Boys visited parks more than girls, and Hispanic children visited parks more often than other children.
- *Parks are important places for physical activity.* Children reported that parks were the second most important location (the first being schools) for physical activity.
- *Many children are driven to parks:* just 33% of inner-city children and 23.5% of suburban children reported walking to the park.
- *The most important characteristics that attracted children to parks were:* the existence of active recreation facilities and organized sport programs, natural features, larger park size, and good maintenance and safety.

- *There are significant gender, racial, and ethnic differences, as well as differences between inner-city and suburban children, in terms of park use patterns, preferences, and perceptions.* For example, children used inner-city parks more than suburban parks and boys used parks more than girls. In addition, park size was more important to inner-city children, while active recreation facilities were more important to suburban children.

While additional research is needed to examine other geographic areas and causal relationships between park characteristics and children's park use, this study's multi-method approach and inclusion of a large number of parks advances our understanding on this important topic. In concluding their article, researchers provide a series of recommendations for planners and park and recreation departments to increase children's park use.

Author Affiliation: Anastasia Loukaitou-Sideris is with the University of California, Los Angeles.

Loukaitou-Sideris, A., & Sideris, A. (2010). What Brings Children to the Park? Analysis and Measurement of the Variables Affecting Children's Use of Parks. *Journal of the American Planning Association*, 76(1), 89-107. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.planning.org/japa/>

Play equipment develops children's interest in specific playgrounds, but other factors are more important in determining how much children actually visit playgrounds

Jansson examined children's use of and preferences for playgrounds in order to identify the qualities that make them successful. The researcher interviewed 86 school children between the ages of 6 and 11, surveyed preschool groups and children's parents, and conducted direct observations of 22 playgrounds in two small towns in southern Sweden to understand what playgrounds children visit and identify the qualities of these playgrounds. All of the playgrounds examined in this study were public and more traditional in nature, but were varied in terms of their size and design. In analyzing the data, Jansson found that in each town there were playgrounds that children visited often and playgrounds that were of particular interest. Interestingly, the researcher found that the most visited playgrounds were different from the most interesting playgrounds. Jansson found that the most important characteristics of interesting playgrounds were particular play equipment, such as a special swing, and the fact that there was an element of renewal or change. With regard to the most visited playgrounds, however, Jansson found that the play equipment was not as important as the character and overall design of the playground (ensuring that there is variation, enclosures, and nature), the social dimension, the ability for children to influence the environment, and being close geographically to schools, housing, and nature. While this study only examined playgrounds in two towns and may be limited due to its small sample size, it provides valuable insight into the qualities that make playgrounds interesting and frequently used. This study highlights the value of place-specific playground approaches.

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

Jansson, M. (2010). Attractive Playgrounds: Some Factors Affecting User Interest and Visiting

Patterns. *Landscape Research*, 35(1), 63-81. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.tandf.co.uk/journals/CLAR>

Different schoolyard areas support different types of physical activity and gender use

Children spend a considerable amount of time in school, making it particularly important to understand the impact of the school environment on children's physical activity. In this study, Fjørtoft and colleagues investigated how 70 6-year-old children at two different schoolyards in Southern Norway use their schoolyard at recess and the environmental characteristics that facilitate children's physical activity. The two schools differed in their location and schoolyard design: one schoolyard was located in a city and had an asphalt area and soccer field, while the other schoolyard was located in a rural area and had an asphalt area and small forest. Researchers used global positioning system technology to track children's movement in each schoolyard, heart rate monitors to measure children's physical activity, and geographic information systems to examine linkages between environmental characteristics and children's movement and physical activity. In analyzing the data, Fjørtoft and colleagues found that children's physical activity levels were similar in both schoolyards, however, different areas of the schoolyards supported different types of physical activity and different gender use. For example, asphalt areas facilitated running and soccer play and were used more by boys than girls, while girls favored the forest area for physical activity. In addition, Fjørtoft and colleagues found that children at both schoolyards were physically active at moderate and vigorous levels for about 20 minutes of their 40 minute recess. While this study examined children in only two schoolyards, it highlights the opportunity that exists to increase children's physical activity levels during school and the importance of investigating environmental factors that support boys' and girls' physical activity.

Author Affiliation: Ingunn Fjørtoft is with Telemark University College in Norway.

Fjørtoft, I., Kristoffersen, B., & Sageie, J. (2010). Children in schoolyards: Tracking movement patterns and physical activity in schoolyards using global positioning system and heart rate monitoring. *Landscape and Urban Planning*, 93

This study may be available in a library near you or can be purchased online through the publisher at: <http://www.elsevier.com>

Nature is widespread in places adolescents use and value

Owens and McKinnon examined the role of nature in the lives of adolescents by identifying places where adolescents go, what activities adolescents participate in at these places, and why these places are important to them. As part of this study, researchers had 58 adolescents, aged 13 through 20, from three California communities (San Luis Obispo, Santa Clara County, and Pasadena) complete a survey about their community place use and feelings and take photographs of the places they discussed. In analyzing the survey and photograph data, Owens and McKinnon identified natural elements in adolescents' responses and photographs. Researchers found that nature exists in many of the places that adolescents use and value, including three major types of places: places that support recreation, restoration, and socialization. Owens and McKinnon discovered that in some



cases natural characteristics played a dominant role in why adolescents use and value a place, whereas in other cases nature played a secondary role. For example, adolescents mentioned going to nature preserves, gardens, and backyards to escape and relax. In concluding their article, Owens & McKinnon highlight the need for longitudinal studies to examine how the importance of natural elements changes throughout the lifecycle: from childhood to adolescence to adulthood.

Author Affiliation: Patsy Owens is with the University of California, Davis.

Owens, P. E., & McKinnon, I. (2009). In pursuit of nature: The role of nature in adolescents' lives. *Journal of Developmental Processes, 4*(1). This study may be available in a library near you or can be purchased online through the publisher at: <http://www.icdl.com/>

Open public spaces are children's favorite places for physical activity

To better understand factors that influence children's physical activity, Rehrer and colleagues had 173 12- to 13-year children from a high school in Dunedin, New Zealand draw a series of maps about their favorite and least favorite places for physical activity, where they went on a particular Sunday, and where they went on the previous school day. In addition, children described why they liked or avoided certain places and how they got to these places. In analyzing the data, Rehrer and colleagues found that open public spaces were children's favorite places for physical activity, with 37% of students citing a beach close to school and 33% citing a nearby park as their favorite places. The most common reasons children liked these places were because of the ability to do specific physical activities, the ability to have fun, and having friends to do an activity with. With regard to least favorite places, researchers discovered that an industrial harbor area, other schools, and cemeteries were children's least favorite places for physical activity. The most common reasons children disliked these places were because of bad people/bullies, it didn't support physical activity, traffic, danger, and they were boring. With regard to children's activities on a Sunday, Rehrer and colleagues found that children made more visits to specific built environments than green spaces and that the majority of children used a car for transport instead of walking or biking. Researchers also found some gender differences. For example, more girls than boys found good weather, living close to facilities, and having friends to do physical activity with important. While this study may be limited due to its small sample size and focus on students from one high school, it provides a valuable contribution to the literature because it focuses on children's perspectives and demonstrates the role of both environmental and social factors in encouraging children's physical activity.

Author Affiliation: Nancy Rehrer is with the University of Otago in New Zealand.

Rehrer, N. J., Freeman, C., Cassidy, T., Waters, D. L., Barclay, G. E., & Wilson, N. C. (2011). Through the eyes of young people: Favourite places for physical activity. *Scandinavian Journal of Public Health.* This study may be available in a library near you or can be purchased online through the publisher at: <http://sjp.sagepub.com/>



Students with more outdoor school facilities are more likely to participate in daily physical activity at recess

Haug and colleagues investigated the relationship between physical environmental characteristics of school grounds and children's physical activity during school breaks. Researchers had over 16,000 students in 4th through 10th grades from 130 schools in Norway complete questionnaires about their physical activity during school classes and recess. Researchers also had principals at each school complete a questionnaire about the school environment and recess opportunities. In analyzing the data, Haug and colleagues found that boys were more active than girls at recess. For example, with regard to primary school children (grades 4-7), 73% of boys and 57% of girls reported that they were physically active during recess. In addition, researchers found that girls' and boys' physical activity peaked in Grade 6 and then declined. With regard to the relationship between physical environmental characteristics and children's physical activity, Haug and colleagues discovered that secondary level students (grades 8-10) were almost three times as likely to participate in daily physical activity during recess if they had a larger number of outdoor facilities at their school. In particular, researchers found that soccer fields, areas for hopscotch/skipping rope, playground equipment and sledding hills supported more physical activity among secondary school boys, while sledding hills supported more physical activity among secondary school girls. Haug and colleagues did not find any relationship between physical environmental characteristics and primary school children's physical activity and discuss several possible reasons for this finding, including less variability in terms of physical activity participation and facility availability. This study may be limited due to its reliance on self-reported information, however, it highlights the important role that outdoor facilities might play in encouraging physical activity in secondary school children, a time when physical activity levels appear to decline.

Author Affiliation: Ellen Haug is with the University of Bergen in Norway.

Haug, E., Torsheim, T., Sallis, J. F., & Samdal, O. (2010). The characteristics of the outdoor school environment associated with physical activity. *Health Education Research, 25(2), 248.* This article may be available in a library near you or can be purchased online through the publisher at: <http://her.oxfordjournals.org/>

Green schoolyards provide rich play environments

In the last 20 years, there have been many school ground naturalization projects in Canada. In this study, Samborski investigated the impact of two different school grounds, one highly vegetated and diverse and the other more barren, on children's use, preferences, and perceptions. Samborski conducted her research with children from two neighboring schools in Victoria, British Columbia that were similar in many respects (e.g., population size, socio-demographics, and size of outdoor space available), but differed in terms of their school ground design and composition, in particular the degree of botanical diversity. To understand the impact of the school grounds on children, Samborski worked with almost 350 students between the ages of 6 and 13. Participating children completed drawings of their school ground, a survey regarding their preferences, participated in a

focus group with other children, and completed a “walking” interview. Samborski found many interesting results, a few of which include the following:

- Children from the “green” school had more intricate drawings and mentioned over three times more plants and animals in their drawings than children from the “barren” school.
- Children from the “green” school mentioned more constructions and surface elements (e.g., forts) in their drawings than children from the “barren” school.
- Children’s preferences for different school ground elements varied by school as well as by age. For example, children from the “green” school preferred more natural elements (e.g., wildflowers, trees and shrubs, and ponds and streams), as compared to children from the “barren” school who preferred swings and fixed play equipment.
- Children at both schools valued dens—vegetative rooms consisting of shrubs that provide some privacy—as places to spend time.

Overall, Samborski found that the “green” school provided more possibilities for play and discovery than the “barren” school. Although this study may be limited due to its focus on only two schools, it provides an important perspective—children’s perspective—on their schoolyard environments. In concluding her article, Samborski discusses implications for school ground management and directions for future research.

Author Affiliation: Sylvia Samborski is with the University of Victoria in Canada.

Samborski, S. (2010). Biodiverse or barren school grounds: their effects on children. *Children, Youth and Environments*, 20(2). This article is available online at: <http://www.colorado.edu/journals/cye/>

Outdoor affordances at child care settings vary based on physical and social factors

Kernan examined children’s outdoor play experiences at four early childhood education and care settings in Dublin, Ireland that represent a diversity of care settings and outdoor environments. She examined children’s experiences in terms of the availability and level of outdoor affordances—what possibilities the environment offers children—in three different parts of each care setting: the indoor-outdoor interface, the enclosed outdoor space, and the wider outdoors in the surrounding neighborhood. To examine children’s experiences, Kernan observed children and conducted interviews and informal discussions with children and practitioners and managers at the care settings. Importantly, she also considered the interactions between children and between children and adults. For each of the care settings, Kernan detailed the outdoor affordances available to children in the three different locations. For example, in one of the child care centers Kernan found that many of the affordances in the wider outdoors were not experienced by children because of the limited view of the outdoors from the inside of the facility, the limited time children had outdoors, and the fact that children largely remained in strollers when outside. While this study may be limited due to its small sample size, it provides a potentially new framework for examining children’s experiences at early childhood education and care settings.

Author Affiliation: Margaret Kernan is with the International Child Development Initiatives in The Netherlands.

Kernan, M. (2010). Outdoor affordances in early childhood education and care settings: adults' and children's perspectives. *Children, Youth and Environments, 20(1)*. This article is available online at: <http://www.colorado.edu/journals/cye/>

Focus: Physical Activity/Fitness & 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/fitness and weight, as well as key factors influencing children's physical activity/fitness and weight.

Research Syntheses:

Suburban children have higher physical activity levels than urban and rural children

Sandercock and colleagues conducted a systematic review of the literature related to children's physical activity levels in different types of built environments (urban, rural, and suburban). The authors reviewed 18 studies from developed countries and discuss their findings in terms of U.S.- and non-U.S. based studies. Many of the studies examined differences in urban and rural children's physical activity. Based on these studies, Sandercock and colleagues found that there were no major differences in children's physical activity levels in urban and rural areas. A majority of the studies did find, however, that younger children (<13 years of age) engaged in more unstructured outdoor play in rural as compared to urban areas. In addition, several studies examined differences in urban, rural, and suburban children's physical activity. Based on these studies, Sandercock and colleagues found that suburban children had the highest physical activity levels, followed by rural and then urban children. The authors suggest that the mixture of rural and urban environmental characteristics (e.g., open spaces and sports facilities) that are often present in suburban environments may be particularly conducive to supporting physical activity. In concluding their review, Sandercock and colleagues discuss limitations of research conducted to date and recommend areas for future research.

Author Affiliation: Gavin Sandercock is with the University of Essex in the UK.

Sandercock, G., Angus, C., & Barton, J. (2010). Physical activity levels of children living in different built environments. *Preventive Medicine, 50(4)*, 193-198. This review may be available in a library near you or can be purchased online through the publisher at: <http://www.elsevier.com/>

Original Research:

Cardiorespiratory fitness has significantly declined in English 10-year-olds from an affluent area

While childhood obesity has been increasing in many countries, cardiorespiratory fitness has been decreasing. Between 1998 and 2008, Sandercock and colleagues investigated changes in the body mass index (BMI) and cardiorespiratory fitness of 10-year-old children from an affluent area of the UK. Researchers recruited about 300 children from similar schools in 1998 and 2008 to participate in the study. Researchers measured children's weight and stature to calculate BMI and used a 20 meter shuttle-run test to assess children's cardiorespiratory fitness. Over the 10-year period, Sandercock and colleagues found that girls' BMI did not change, however, there was a significant increase in boys' BMI. They also found a significant decline in performance for both boys and girls in the 20 meter shuttle-run test. Importantly, Sandercock and colleagues discovered that the rate of decline in cardiorespiratory fitness between 1998 and 2008 was between 7-9% for this group of children, almost twice the predicted global average rate of decline. Based on the study results, researchers suggest that schools may need to assess cardiorespiratory fitness, in addition to BMI, particularly since BMI and cardiorespiratory fitness are not necessarily linked, to better monitor and promote children's health.

Author Affiliation: Gavin Sandercock is with the University of Essex in the UK.

Sandercock, G., Voss, C., McConnell, D., & Rayner, P. (2010). Ten year secular declines in the cardiorespiratory fitness of affluent English children are largely independent of changes in body mass index. *Archives of Disease in Childhood*, 95(1), 46-47. This study may be available in a library near you or can be purchased online through the publisher at: <http://adc.bmj.com/>

In 1999-2002, less than 0.5% of U.S. adolescents met current nutrition, exercise, and screen time recommendations

In 2007, health care experts released a series of 4 recommendations concerning daily nutrition and physical activity to help prevent obesity: 1) children and adolescents consume 5 or more servings of fruits/vegetables a day; 2) engage in less than 2 hours of screen time; 3) engage in more than 1 hour of physical activity; and 4) consume no (0) sugar-sweetened beverages (often referred to as the "5-2-1-0" criteria). With these recommendations being used by health providers to help combat obesity, it is important to understand the extent to which U.S. children met or failed to meet these guidelines prior to their release so that the success of prevention efforts can be evaluated. In this study, Foltz and colleagues analyzed 1999-2002 National Health and Nutrition Examination Survey (NHANES) data for over 4,000 adolescents (ages 12-19) to determine how many U.S. adolescents would have met the 5-2-1-0 guidelines before they were released in 2007. Specifically, researchers analyzed NHANES interview and health examination data, which included a food diary and questions about screen time and physical activity. Foltz and colleagues found that only 0.4% of U.S. adolescents would have met all four 5-2-1-0 guidelines, while 41% of adolescents would not have met any of the guidelines. Importantly, researchers found that very few adolescents would have met each individual

guideline. For example, they discovered that only 9% of adolescents ate 5 or more servings of fruits/vegetables, 27% engaged in less than 2 hours of screen time, 32% engaged in more than 1 hour of physical activity, and 14% drank no sugar-sweetened beverages each day. While Foltz and colleagues found some differences among different demographic subgroups, they found that all subgroups were far from meeting the current guidelines and thus could benefit from prevention efforts. This study may be limited due to its reliance on self-reported measures and the accuracy of participant memories, however, its use of a nationally representative sample, composed of many adolescents, provides a valuable contribution to our understanding of this topic. Foltz and colleagues hope that their research can help guide health intervention activities and serve as a baseline from which to evaluate prevention efforts and future adolescent health behaviors.

Author Affiliation: Jennifer Foltz is with the University of Rochester School of Medicine and Dentistry.

Foltz, J. L., Cook, S. R., Szilagyi, P. G., Auinger, P., Stewart, P. A., Bucher, S., et al. (2011). US adolescent nutrition, exercise, and screen time baseline levels prior to national recommendations. *Clinical Pediatrics*, 50(5), 424. This study may be available in a library near you or can be purchased online through the publisher at: <http://cpj.sagepub.com/>

Prevalence of high BMI in children has remained steady for 10 years, but 6- to 19-year-old-boys with the highest BMI may be getting heavier

Children with high body mass index (BMI) are at greater risk for a range of health problems now and in the future. Ogden and colleagues analyzed data from the 2007-2008 National Health and Nutrition Examination Survey to investigate the prevalence of high BMI among 2- to 19-year-old children and high weight for recumbent length among infants and toddlers (less than 2 years-old). Researchers analyzed data for 3281 children and 719 infants and toddlers. Ogden and colleagues found that in 2007-2008, 10% of infants and toddlers were at or above the 95th percentile of weight for recumbent length. With regard to children between the ages of 2 and 19, researchers found that 11.9% of children were at or above the 97th percentile for BMI, 16.9% were at or above the 95th percentile for BMI, and 31.7% were at or above the 85th percentile for BMI. In looking at trends over time, Ogden and colleagues found no significant linear trends for infants and toddlers or for girls of any age between 1999 and 2008. Researchers did, however, find a significant linear trend at the highest BMI (97th percentile) for boys between the ages of 6 and 19. The results of this study suggest that the prevalence of high weight for recumbent length in infants and toddlers, and high BMI in female children has remained steady for the last 10 years and has not declined, and that 6-19-year-old-boys with the highest BMI may be getting heavier.

Author Affiliation: Cynthia Ogden is with the National Center for Health Statistics at the Centers for Disease Control and Prevention.

Ogden, C. L., Carroll, M. D., Curtin, L. R., Lamb, M. M., & Flegal, K. M. (2010). Prevalence of High Body Mass Index in US Children and Adolescents, 2007-2008. *JAMA-Journal Of The American Medical Association*, 303(3), 242-249. This study may be available in a library near you or can be purchased online through the publisher at: <http://jama.ama-assn.org/>

Childhood & adolescent obesity rates remain high

In the eighth edition of *F as in Fat*, Levi and colleagues review current trends in obesity rates, as well as state and federal policies designed to address the obesity epidemic. To investigate childhood obesity rates, researchers reviewed evidence from the 2007 National Survey of Children's Health. Levi and colleagues report that 16.4% of children ages 10-17 were obese (defined as having a BMI at or above the 95th percentile), while 18.2% of children ages 10-17 were overweight (defined as having a BMI at or above the 85th percentile, but lower than the 95th percentile). In examining state-specific rates, Levi and colleagues found that childhood obesity rates ranged from 9.6% in Oregon to 21.9% in Mississippi. In 2007, nine states (Arkansas, Georgia, Illinois, Kentucky, Louisiana, Mississippi, Tennessee, Texas, and West Virginia) and Washington D.C. had childhood obesity rates greater than 20%, whereas in 2003, only 3 states and Washington D.C. had childhood obesity rates higher than 20%. In addition, researchers reported that 9 of the 10 states with the highest rates of obese children were located in the South. Levi and colleagues also examined obesity rates among high school students as part of the 2009 National Youth Risk Behavior Survey and children ages 2-5 from lower-income families as part of the Pediatric Nutrition Surveillance Survey. Researchers report that 12% of high school students were obese and 15.8% were overweight, while 14.8% of 2-5 year-old children from lower-income families were obese as compared to the national rate of 12.4% for children of a similar age. In addition to discussing current obesity rates and trends, Levi and colleagues highlight state and federal policies and programs, as well as community efforts, to reduce obesity, and provide recommendations for enhancing obesity prevention efforts.

Author Affiliation: Jeffrey Levi is with the Trust for America's Health.

Levi, J., Segal, L., Laurent, R., & Kohn, D. (2011). *F as in fat: How obesity threatens America's future*. Trust for America's Health, Robert Wood Johnson Foundation. This report is available online at: <http://healthyamericans.org/report/88/>

Canadian children today are taller, heavier, larger, and weaker than in 1981

Tremblay and colleagues analyzed data from the 2007-2009 Canadian Health Measures Survey: the first comprehensive, national survey in more than two decades designed to assess the fitness of Canadians. The survey involved a detailed health interview, as well as body composition measurements and fitness tests. In this article, researchers provide an assessment of over 2,000 6- to 19-year-old Canadian children's fitness levels, and when possible compare current information with findings from a similar 1981 fitness survey. In analyzing the data, Tremblay and colleagues found that there are many significant differences between boys' and girls' fitness levels. For example, boys' mean grip strength was higher than girls', regardless of age. Researchers also found that children's fitness levels change significantly between the ages of 6 and 19. For example, body mass index and waist circumference increased with age. When comparing 2007-2009 survey data to 1981 data, Tremblay and colleagues discovered that children's fitness levels have significantly declined. They found that children are taller, heavier, larger and weaker now than they were in 1981. For example,

compared to a 12-year-old boy in 1981, a 12-year-old boy in 2007-2009 was, on average, about 2 inches taller, 14 pounds heavier, had a larger waist and hip circumference, a higher BMI, and reduced grip strength and flexibility. While this study may be limited due to its use of certain screening criteria, it provides valuable information on the fitness levels of Canadian children, which can help inform interventions to improve fitness, as well as future assessments.

Author Affiliation: Mark Tremblay is with the Children's Hospital of Eastern Ontario Research Institute and University of Ottawa in Canada.

Tremblay, M. S., Shields, M., Laviolette, M., Craig, C. L., Janssen, I., & Gorber, S. C. (2009). Fitness of Canadian children and youth: Results from the 2007-2009 Canadian health measures survey. *Health Reports, 21(1)*. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.statcan.gc.ca/ads-annonces/82-003-x/index-eng.htm>

Many U.S public elementary and secondary schools are not doing enough to support students' healthy eating and physical activity behaviors

In 2004, the Child Nutrition and WIC Reauthorization Act required school districts participating in federal child nutrition programs to develop a wellness policy with regard to nutrition and physical activity by the start of the 2006-07 school year. Following the wellness mandate, in 2007 and 2008, University of Illinois researchers collected data on nutrition and physical activity policies and practices from a nationally representative sample of public elementary and secondary schools. Researchers collected data from school administrators via a mail-back survey and weighted the data to reflect the percentage of students nationwide who attended a school with the policy or practice examined in the surveys. A few of the key findings from 2007-08 include:

- More than 80% of secondary school students and 62% of public elementary school students had access to at least one competitive food or beverage venue (e.g., vending machines, school stores and/or snack bars). These venues generally offer less-healthy items, such as soda, candy, and cookies.
- While most secondary schools offered vegetables and fresh fruits some or most days of the week as part of the lunch program, only 20% of elementary school students had salad bars and whole grains available most or all days of the week.
- 32% of third-grade students did not receive at least 20 minutes of recess a day.
- 21% of elementary school students, 25% of middle school students, and 14% of high school students walked or biked to school.
- 34% of elementary school students, 54% of middle school students, and 16% of middle school students attended a school that annually tested students' physical fitness.

While many schools have made positive changes to help create a healthier environment for their students, researchers found that more changes are needed. Researchers highlight a number of opportunities for changing policies and/or practices to continue to improve student health.

Author Affiliation: Lindsey Turner and Lloyd Johnston are with the Institute for Health Research and Policy at the University of Illinois at Chicago.



Turner, L., & Chaloupka, F. J. (2010). *School policies and practices to improve health and prevent obesity: National elementary school survey results: School years 2006-07 and 2007-08* University of Illinois.

Johnston, L. D., O'Malley, P. M., Terry-McElrath, Y., Freedman-Doan, P., & Brenner, J. S. (2011). *School policies and practices to improve health and prevent obesity: national secondary school survey results, school years 2006-07 and 2007-08* University of Illinois.

These reports are available online at: <http://www.bridgingthegapresearch.org/>

American voters consider childhood obesity a serious problem & support investing in a comprehensive program to combat childhood obesity

Quinian and colleagues conducted a national survey of 1,200 registered voters to examine their views on childhood obesity. Researchers found that 81% of American voters agreed that childhood obesity is a serious problem. Importantly, this viewpoint was shared across different demographic groups, regional areas of the country, and political groups. In addition, Quinian and colleagues found that 73% of voters felt that the government should treat childhood obesity as a top priority and 56% believed that it is important to invest in a comprehensive program to combat childhood obesity, even if it increases government spending. Researchers also found that voters are optimistic about the future of childhood obesity, with 61% of voters believing that the childhood obesity epidemic can be solved within a generation.

Author Affiliation: Al Quinian is with Greenberg Quinan Rosner Research.

Quinian, A., Lieberman, D., & Ferguson, G. (2010). *American voters support investment in preventing childhood obesity: Greenberg Quinan Rosner Research, American Viewpoint.* This report is available online at: http://www.greenbergresearch.com/articles/2472/5744_TFAH%20Memo.pdf

Children with low levels of physical activity and high levels of screen-time are almost two times as likely to be overweight

Given the prevalence of childhood obesity, studies have started to examine relationships between children's sedentary behaviors, such as screen-based leisure time (television, video, computer) and physical activity. In this study, Sisson and colleagues further explore this relationship by examining data from the 2003 National Survey of Children's Health, which included a national sample of over 50,000 children 6-17 years of age. As part of the survey, parents provided information on their child's physical activity, screen-time, and height and weight. In analyzing the data, Sisson and colleagues found that 25.5% of children engaged in at least 20 minutes of physical activity every day of the week, about 44% spent 2 or more hours engaged in screen-based leisure time, and 35.3% of children were overweight. Importantly, researchers found that, for both boys and girls, higher levels of daily screen-time were associated with lower levels of daily physical activity. In addition, Sisson and colleagues found that children with low levels of weekly physical activity and high levels of daily

screen-time were significantly more likely to be overweight. In fact, researchers found that children with low levels of physical activity and high levels of screen-time were almost 2 times as likely to be overweight as children with high levels of physical activity and low levels of screen-time. While this study may be limited due to its reliance on parent reporting and the fact that researchers did not consider children's eating habits, with its large, nationally representative sample this study provides a valuable contribution to our understanding of childhood obesity.

Author Affiliation: Susan Sisson is with the University of Oklahoma Health Science Center and Pennington Biomedical Research Center is Louisiana.

Sisson, S. B., Broyles, S. T., Baker, B. L., & Katzmarzyk, P. T. (2010). Screen Time, Physical Activity, and Overweight in U.S. Youth: National Survey of Children's Health 2003. *Journal of Adolescent Health*. This study may be available in a library near you or can be purchased online through the publisher at: <http://jahonline.org/>

Children are largely indoors and sedentary at preschool

Many children in the U.S. attend center-based preschools. Given recent trends in childhood obesity, preschools could be an important setting for interventions. In this study, Brown and colleagues investigated children's physical activity in preschools to determine which conditions supported different physical activity levels during outdoor play. Researchers observed over 450 3- to 5-year-old children from 24 different preschools (commercial child-care centers, church-affiliated preschools, or Head Start programs) in a metropolitan area of South Carolina. Brown and colleagues recorded children's physical activity behaviors and the social and nonsocial environmental factors related to those behaviors (e.g., group composition and indoor and outdoor activity contexts). In analyzing the data, researchers found many interesting results, including the following:

- Children are largely indoors and sedentary at preschool: 87% of researchers' observations of children occurred inside and during this inside time, 94% of children's total physical activity intervals were sedentary.
- Children were largely sedentary outdoors, but displayed higher levels of physical activity outside than inside: 17% of children's total physical activity intervals were moderate to vigorous and 56% were sedentary.
- When outside, children were observed most often in open spaces, using fixed equipment, using balls or other objects, using socio-dramatic props, or using wheeled toys. Children were most often observed in high-level physical activity in open spaces or when playing with balls and other objects.
- Adults initiated the majority of children's activities and most activities took part in groups.
- Children engaged in more high-level physical activity when activities were child-initiated instead of adult-initiated.
- Many teachers did not encourage or participate in children's physical activities during outdoor play.

While this study may be limited due to its reliance on observational data, its relatively large sample of

diverse participants provides an important contribution to the literature. In concluding their article, Brown and colleagues make a series of recommendations for researchers, as well as for early childhood policy makers and practitioners, including the need for intentional and active adult involvement in children's outdoor activities.

Author Affiliation: William Brown is with the University of South Carolina.

Brown, W. H., Pfeiffer, K. A., McIver, K. L., Dowda, M., Addy, C. L., & Pate, R. R. (2009). Social and Environmental Factors Associated With Preschoolers' Nonsedentary Physical Activity. *Child Development, 80*(1), 45-58. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.wiley.com/>

A lot of children's recreational physical activity takes place outdoors and with friends

Dunton and colleagues examined where and with whom children engage in recreational exercise and sports. Researchers analyzed 4 years of data from a large, nationally representative time use survey. As part of this survey, children between the ages of 15 and 18 participated in a telephone interview where they described their activities for a 24-hour period, as well as where and with whom each activity occurred. In analyzing data for over 850 children, Dunton and colleagues found that the majority of children's recreational physical activity occurred with friends/acquaintances/other (50%), alone (19%), or with family members (18%). In terms of location, researchers found that children's recreational physical activity occurred at: other/unspecified locations (29%), school (24%), outdoors (22%), home (16%), and at someone else's house (8%). With regard to gender, Dunton and colleagues discovered that girls were more likely to exercise with family than boys, while boys were more likely to exercise with friends/acquaintances/other and outdoors than girls. With regard to age, researchers found that 18-year-olds were more likely to engage in recreational physical activity alone and less likely to engage in physical activity at school. While this study may be limited by its reliance on self-reported information and the categories researchers used to describe social and environmental contexts, it provides valuable insight into where and with whom children participate in recreational sports and exercise. Based on their study, Dunton and colleagues recommend that program and planning efforts focus on encouraging peer-based and outdoor activities to support children's recreational physical activity.

Author Affiliation: Genevieve Dunton is with the University of Southern California.

Dunton, G. F., Berrigan, D., Ballard-Barbash, R., Perna, F. M., Graubard, B. I., & Atienza, A. A. (2010). Adolescents' Sports and Exercise Environments in a US Time Use Survey. *American Journal of Preventive Medicine, 39*(2), 122-129. This review may be available in a library near you or can be purchased online through the publisher at: <http://www.elsevier.com/>

Child-care centers' social and physical environments influence children's physical activity levels

With over half of European children attending some form of child-care, it is important to

understand how these environments impact children's physical activity. In this study, Gubbels and colleagues examined the relationship between child-care center environments and children's physical activity by observing 175 2-to3-year-old children at 9 Dutch child-care centers. Researchers assessed children's physical activity intensity, the social environment (e.g., group size and physical activity prompts), and the physical environment (e.g., portable and fixed equipment). In analyzing the data, Gubbels and colleagues found that the majority of children's activity was sedentary (59.4% of indoor activity and 31.2% of outdoor activity), however, children's physical activity levels were more intense outdoors, with 21.3% of activity being classified as moderate to vigorous as compared to 5.5% of activity indoors. With regard to the relationship between children's physical activity and social and physical environment factors, Gubbels and colleagues found that more activity opportunities in the physical environment (both indoors and outdoors) and physical activity prompts by staff (outdoors) and peers (indoors) were related to higher activity intensities, while larger group size was related to lower activity intensities. In addition, researchers discovered that the social environment interacts with the physical environment to influence children's physical activity intensity. For example, Gubbels and colleagues found that the outdoor physical environment influenced children's physical activity only when children engaged in an activity with multiple other peers and that positive physical activity prompts from peers more positively impacted boys' outdoor physical activity. This study, while potentially limited due to its small sample size and reliance on observational data, demonstrates the value of examining physical and social environmental factors and highlights the importance of including child-care environments in efforts to improve children's physical activity levels and prevent childhood obesity.

Author Affiliation: Jessica Gubbels is with Maastricht University Medical Center in the Netherlands.

Gubbels, J. S., Kremers, S. P. J., van Kann, D. H. H., Stafleu, A., Candel, M. J. J. M., Dagnelie, P. C., et al. (2011). Interaction between physical environment, social environment, and child characteristics in determining physical activity at child care. *Health Psychology, 30*(1), 84. This article may be available in a library near you or can be purchased online through the publisher at: <http://hpq.sagepub.com/>

Neighborhood features that influence children's BMI may change as children mature

The impact of environmental characteristics on children's weight is becoming an increasingly popular area of study, however, most studies to date have examined relationships at one-point in time (cross-sectional design) and have reported inconsistent findings. In this study, Timperio and colleagues examined both cross-sectional and longitudinal relationships between physical activity-related neighborhood features and weight among 140 5- to 6-year-old and 269 10- to 12-year-old children from Melbourne, Australia and their female caregivers in 2001 and 2004. Researchers collected information on participants' height and weight and used a geographic information system (GIS) to assess various physical activity-related neighborhood features (e.g., access to public open spaces, density of cul-de-sacs and intersections, length of busy roads, etc.) within 800m and 2km of each child's residence. In analyzing the data, Timperio and colleagues did not find many neighborhood features that were associated with children's weight or weight changes. Significant relationships that they did discover, however, were different for younger and older children and

were not consistent among cross-sectional (single-year) and longitudinal (across 3 years) analyses. For example, older children who lived in neighborhoods with a higher density of public open spaces dedicated as sport/recreation, had lower BMIs, however, these findings did not hold up when examined longitudinally (across the 3 years). Timperio and colleagues believe that these findings suggest that important features may change as children mature. This study may be limited due to its small sample size and focus on physical neighborhood features, however, researchers' use of objective neighborhood measures and a longitudinal design provide an important contribution to the literature. Additional research is needed to identify physical-activity related environmental factors that consistently impact children's weight status and thus can be a target of design interventions.

Author Affiliation: David Crawford is with Deakin University in Australia.

Timperio, A., Jeffery, R. W., Crawford, D., Roberts, R., Giles-Corti, B., & Ball, K. (2010). Neighbourhood physical activity environments and adiposity in children and mothers: a three-year longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity*, 7(1), 18. This study may be available in a library near you or can be purchased online through the publisher at: <http://www.ijbnpa.org/>

Children's travel behavior is complex and there are many opportunities to make it more sustainable and healthy

In this review, O'Brien and colleagues examine the literature surrounding the travel behavior of 12- to 18-year-old children. The authors focus on this issue because of recent trends in childhood obesity and physical inactivity, as well as increased rates of car travel and the impact of land use on transport behavior. O'Brien and colleagues discuss where children travel and what modes of transport they use. For example, the authors highlight evidence demonstrating that children's motorized transport has increased, while active transport has decreased over the years. O'Brien and colleagues also review evidence regarding the relationship between urban form and children's travel, including how travel choices are impacted by a variety of environmental variables, such as residential density and recreation/open space. The authors discuss various demographic characteristics and children's travel behavior, including the influence of gender, socioeconomic status, and ethnicity, as well as parental influence on travel behavior. O'Brien and colleagues also review evidence concerning the linkages between transportation, urban form, and children's health and well-being, including physical activity, noise, and air quality. Finally, the authors present a series of recommendations for involving youth in policy development and planning, as well as for future research and actions.

Author Affiliation: Catherine O'Brien is with Cape Breton University in Canada.

O'Brien, C., Ramanathan, S., Gilbert, R., & Orsini, A. (2009). *Youth and sustainable transportation: A review of the literature*. The University of Winnipeg. This report is available online at: <http://www.kidsonthemove.ca/uploads/Youth%20and%20Sustainable%20Transportation,%20Review%20of%20the%20Literature.pdf>

Children who actively commute to school have higher physical activity levels

Faulkner and colleagues systematically review research to determine whether children who actively commute to school are more physically active and have a healthier body weight than children who travel by motorized transport. The authors examined thirteen studies focused on these issues. In reviewing the evidence, Faulkner and colleagues reported that eleven of the thirteen studies found that children who actively commuted to school were more physically active than children who took motorized transport. The authors also found some evidence for age and gender differences in terms of the relationship between active commuting and physical activity, but no clear pattern emerged as the results were often conflicting. With regard to the relationship between active commuting and body weight, Faulkner and colleagues found that only one of ten studies found that active commuters had a lower body weight than passive commuters. In concluding their article, the authors discuss limitations of research conducted to date and recommend areas for future research.

Author Affiliation: Guy Faulkner is with the University of Toronto in Canada.

Faulkner, G. E. J., Buliung, R. N., Flora, P. K., & Fusco, C. (2009). Active school transport, physical activity levels and body weight of children and youth: A systematic review. *Preventive Medicine, 48*(1), 3-8. This review may be available in a library near you or can be purchased online through the publisher at: <http://www.elsevier.com/>

Children who actively commute to school are more active and engage in more moderate to vigorous physical activity

While active commuting to school has been linked to higher physical activity levels, little is known about the actual journey to school. Cooper and colleagues investigated children's level and location of physical activity during the school commute. As part of this study, 137 11-year-old children in west London wore an accelerometer for one week and a global positioning system receiver for two days. Participating children also completed a diary and survey. In analyzing the data, Cooper and colleagues found that 51% of the children walked to school, 34% traveled by car, 13% traveled by bus, and 1.5% traveled by bicycle. In terms of physical activity, researchers found that children who walked to school were more active in the hour before school and engaged in more moderate to vigorous physical activity than children who traveled by car. Cooper and colleagues also discovered that children took very direct routes to school and spent time on the playground before school started. In terms of physical activity, researchers found that children were more physically active during the journey to school as compared to on the playground before school. While this study may be limited due to its small sample size, it demonstrates the important role that active commuting to school can play in supporting children's physical activity.

Author Affiliation: Ashley Cooper is with the University of Bristol in the UK.

Cooper, A. R., Page, A. S., Wheeler, B. W., Griew, P., Davis, L., & Hillsdon, M. (2010). Mapping the walk to school using accelerometry combined with a Global Positioning System. *American Journal of Preventive Medicine, 38*(2). This review may be available in a library near you or can be purchased

Social support and environmental perceptions impact children's active commuting to school

Panter and colleagues investigated whether children's active commuting to school is associated with attitudes, social support, and environmental perceptions and whether distance to school impacts these associations. As part of this study, over 2,000 9- to 10-year-old children from urban and rural schools in Norfolk, UK and their parents completed questionnaires about travel behavior, socio-demographic information, attitudes towards active commuting, social support, and neighborhood environments. In addition, researchers measured the distance from home to school for each child using a geographic information system. In analyzing the data, Panter and colleagues found that 40% of children usually walked to school, 9% cycled, and 51% used motorized travel. In addition, researchers found that children were more likely to walk to school if their journey to school was less than 1km and their mothers actively commuted to work. With regard to the relationship between attitudes, social support, and environmental perceptions and active commuting, Panter and colleagues discovered that parental attitudes and safety concerns, social support from parents and friends, and neighborhood walkability were related to higher rates of active commuting among children. In addition, researchers found that journey distance moderated the impact of attitudes on cycling behaviors, but that social support and environmental perceptions were important whether the journey to school was long or short. This study may be limited due to its reliance on self-reported data and is cross-sectional in nature and thus causation cannot be examined, however, it is based on data from a large-scale, population-based study and improves our understanding of factors influencing children's active commuting. Based on their findings, as well as findings from other studies, Panter and colleagues recommend that interventions focused on increasing children's active commuting focus on road safety as well as parental and peer support.

Author Affiliation: Jenna Panter is with the University of East Anglia in the UK.

Panter, J. R., Jones, A. P., van Sluijs, E. M. F., & Griffin, S. J. (2010). Attitudes, social support and environmental perceptions as predictors of active commuting behaviour in school children. *Journal of Epidemiology and Community Health*, 64(01), 41. This article may be available in a library near you or can be purchased online through the publisher at: <http://jech.bmj.com/>

Children with higher levels of independent mobility participate more in a range of physical activities

Children's physical activity behavior may vary based on context (e.g., whether it is school based exercise or active commuting to school). In this study, Page and colleagues investigated whether children's independent mobility (children's ability to move around their neighborhood on their own), perceptions of the environment, and distance from home to school were related to the frequency with which they participated in three different types of physical activity—outdoor play, structured exercises and sports, and active commuting to school. Researchers used data from a large study of over 1,300 10- to 11-year-old children from 23 schools in a large UK city. As part of the

study, children completed computerized questionnaires about their outdoor play, exercise/sport activity, and travel from home to school, as well as their independent mobility and perceptions of their environment. Researchers examined children's local (travel to best friend's house, local shops, and park or playground) as well as area (travel to swimming pool, library, cinema, arcade, bus stop, sports and shopping center) independent mobility. In analyzing the data, Page and colleagues found that boys reported taking part significantly more often in outdoor play and exercise/sport activities than girls. Researchers also found that boys had significantly higher local independent mobility and perceptions of personal and traffic safety than girls. With regard to factors influencing children's outdoor play, exercise/sport activities, and active commuting to school, Page and colleagues found the following:

- *Outdoor Play:* Boys played outside more if they scored higher in independent mobility (local and area) and social norm (more children around to play with). Girls played outside more if they scored higher in area independent mobility, social norm, and traffic safety.
- *Exercise/Sports Activities:* Boys participated in more exercise/sport activities if they scored higher in local independent mobility, personal safety, and had easier access to facilities. Girls participated in more exercise/sport activities if they had easier access to both school and friend's homes, access to a broader range of facilities, and more space to play both inside and outside the home.
- *Active Commuting to School:* Boys actively commuted to school more often if they scored higher in local independent mobility and reported having greater accessibility to school and friend's homes and other destinations. Girls actively commuted to school more often if they scored higher in local independent mobility. Finally, both girls and boys actively commuted more to school if they lived closer to school.

While this study may be limited due to its reliance on self-reported information and is correlational (not causal), it demonstrates the important relationship between independent mobility and increased levels of different types of physical activity and provides valuable information that can help inform physical activity interventions for girls and boys.

Author Affiliation: Angie Page is with the University of Bristol in the UK.

Page, A. S., Cooper, A. R., Griew, P., & Jago, R. (2010). Independent mobility, perceptions of the built environment and children's participation in play, active travel and structured exercise and sport: the PEACH Project. *International Journal of Behavioral Nutrition and Physical Activity*, 7.

This study may be available in a library near you or can be purchased online through the publisher at: <http://www.ijbnpa.org/>

Urban and rural children and parents identify a number of barriers and facilitators to children's physical activity

Moore and colleagues investigated barriers and facilitators of rural and urban middle school children's physical activity. Researchers held 13 focus groups with a total of 41 children and 50 parents from one rural and two urban middle schools in eastern North Carolina. In analyzing data from child and parent focus groups, Moore and colleagues found that parents most often identified



distance, cost, crime/danger, and television as primary barriers to children's physical activity, while children most often mentioned school policies and crime/danger as primary barriers to their physical activity. With regard to facilitators of physical activity, Moore and colleagues found that parents most often mentioned social/peer interactions, recreation facilities (indoor and outdoor), and parental role modeling, while children most often mentioned social/peer interactions and recreation facilities as primary facilitators of their physical activity. In addition, researchers discovered some differences among urban and rural children and their parents. For example, urban parents were more concerned about gang activity and peer violence as compared to rural parents who were less concerned about crime. Finally, with regard to future physical activity venues, Moore and colleagues found that both parents and children highlighted the need for indoor facilities that enable family/social time and participation in a variety of activities. While the sample size of this study is small, it provides valuable information on barriers and facilitators of children's physical activity and a unique rural and urban perspective. Moore and colleagues highlight the need for additional research in this area and the importance of balancing parent and child, as well as urban and rural, needs to enhance children's physical activity.

Author Affiliation: Justin Moore is with East Carolina University.

Moore, J. B., Jilcott, S. B., Shores, K. A., Evenson, K. R., Brownson, R. C., & Novick, L. F. (2010). A qualitative examination of perceived barriers and facilitators of physical activity for urban and rural youth. *Health Education Research, 25*(2), 355. This article may be available in a library near you or can be purchased online through the publisher at: <http://her.oxfordjournals.org/>

Parents are concerned about letting children engage in independent physical activity

Jago and colleagues investigated parental decision-making around children's independent physical activity, including attitudes towards children's independent activity, factors that limit children's independent activity, and strategies parents use to manage children's independent activity. Researchers conducted phone interviews with 24 parents of 10- to 11-year-old children from six socioeconomically diverse primary schools in Bristol, UK. In analyzing the data, Jago and colleagues found that parents reported four main factors that limited children's independent physical activity: 1) lack of appropriate space; 2) safety concerns, and in particular local traffic; 3) lack of friends that lived close to home; and 4) older children in outdoor spaces. With regard to parental attitudes towards children's independent physical activity, researchers found somewhat conflicting information. For example, they discovered that parents felt that 10 to 11 years of age was an important age to afford children more independence, but that parents were concerned about the freedom that other parents gave to their children and reported some regret about not giving their own children more freedom. Finally, Jago and colleagues found that parents implemented three primary strategies to manage children's independent physical activity: 1) setting time limits; 2) defining clear geographic boundaries; and 3) allowing activity to only happen in groups. Researchers highlight the importance of addressing parent perceptions and behaviors, including building parental confidence, implementing strategies to facilitate safe physical activity for children (e.g., group activities and traffic calming measures), and increasing understanding of the linkages between

parent-child behavior. This study may be limited due to its small sample size and geographic focus, however, it provides valuable information about parental attitudes and behaviors regarding children's independent physical activity.

Author Affiliation: Russell Jago is with the University of Bristol in the UK.

Jago, R., Thompson, J. L., Page, A. S., Brockman, R., Cartwright, K., & Fox, K. R. (2009). Licence to be active: parental concerns and 10-11-year-old children's ability to be independently physically active. *Journal of Public Health, 31(4), 472-477.* This study may be available in a library near you or can be purchased online through the publisher at: <http://www.springer.com/>

Focus: Environmental Knowledge, Attitudes, & Behavior

Children's exposure to nature may influence their environmental knowledge, attitudes, and behavior as children, as well as throughout their lives. These articles examine various facets of children's environmental knowledge, attitudes, and behaviors.

Research Syntheses:

Understanding how children come to care about the natural world

In this review, Chawla examines developmental pathways related to children's active care for the natural world. Specifically, Chawla focuses on three key factors that have been associated with active care for the environment: motivation to care for nature, a sense of efficacy, and knowledge of action skills and strategies. In examining these factors, she draws on three developmental models or frameworks and discusses research in light of these models. A few of the findings Chawla highlights in her review are: 1) the important role of socializers (e.g., influential family members, teachers, or other adult mentors) within the context of the surrounding culture; 2) that children come to value environmental actions through a variety of mechanisms (interest/enjoyment value, attainment value, utility value, and relative cost); 3) empathy and sympathy are a foundation for the development of care for the natural world; and 4) the importance of providing opportunities for children to develop a sense of efficacy to achieve environmental goals, such as through mastery experiences. This review provides an important new perspective on how children develop care for the natural world. In concluding her review, Chawla discusses future research needs.

Author Affiliation: Louise Chawla is with the University of Colorado Denver.

Chawla, L. (2009). Growing up green: Becoming an agent of care for the natural world. *Journal of Developmental Processes, 4(1).* This article may be available in a library near you or can be purchased online through the publisher at: <http://www.icdl.com/staging/bookstore/journal/index.shtml>

Original Research:

Children have little biodiversity knowledge

In 2009, Airbus surveyed 1,500 children in the UK between the ages of 5 and 10 and their parents to investigate children's biodiversity knowledge. Researchers had children complete a picture survey that tested their knowledge of nature, while parents answered questions related to their child's nature experiences and knowledge. In analyzing the data, Airbus reports some interesting findings, including the following:

- 40% of children could not tell the difference between a bee and a wasp.
- 30% of children did not know what a moose looked like.
- 25% of children did not know what a beaver looked like.
- 83% of children said they enjoyed learning about nature.
- 70% of parents said they were concerned that their child does not know enough about nature.
- 69% of parents said they were concerned that their child spends too much time indoors.

While this survey relied on self-reported information and it is difficult to know how these results compare to knowledge and experiences in the past, this survey highlights children's current knowledge of certain biodiversity topics and could serve as an important baseline from which to compare future measurements.

Author Affiliation: This survey was conducted by Airbus, an aircraft manufacturer in the UK.

Airbus. (2009). The Greenwave program: Research results. This document is available online at: <http://www.cbd.int/doc/groups/youth/greenwave/greenwave-research-results-summary-2009-en.pdf>

Children's interest and relationship to nature and vegetation varies by context (urban vs. rural) and gender

Laaksoharju and Rappe investigated the role that vegetation plays in the lives of 9- to 10-year-old Finnish schoolchildren from urban and rural areas. Researchers were particularly interested in examining gender differences, as well as urban and rural differences. As part of this study, 76 children completed a survey about vegetation in their lives, as well as a drawing task to assess their ability to draw a plant and represent its anatomy. In addition, Laaksoharju and Rappe assessed the impact of a small horticultural intervention, where several urban children learned about fruit plants through a series of indoor, hands-on classroom sessions and completed a post-intervention survey. In analyzing the data, researchers found that rural children had closer contact with nature and green plants than urban children and that girls were more interested in vegetation than boys. For example, rural children knew trees by name better than urban children and girls were more interested in learning about plants than boys. With regard to the horticultural intervention, Laaksoharju and Rappe found that children's general knowledge about plants improved somewhat. While this study may be limited due to its small sample size, it provides valuable insight into differences in children's relationship with nature and vegetation. In concluding their article, researchers suggest additional

areas of research as well as the need for horticultural interventions that take place outdoors and consider gender differences.

Author Affiliation: Taina Laaksoharju is with the University of Helsinki in Finland.

Laaksoharju, T., & Rappe, E. (2010). Children's Relationship to Plants among Primary School Children in Finland. *HortTechnology*. This article may be available in a library near you or can be purchased online through the publisher at: <http://horttech.ashspublications.org/>

Children's emotional affinity towards nature is a strong predictor of their willingness to protect the environment

Müller and colleagues examined the relationship between children's emotional connection or affinity towards nature and their willingness to protect the environment in two different European societies, Germany and Lithuania, and contexts, urban and rural. Researchers had over 400 high school students in 11th and 12th grades from urban and rural environments in Lithuania and Germany complete a survey to assess their emotional affinity towards nature, awareness of environmental risks, current contact with nature, and willingness for pro-environmental commitment. In analyzing the data, Müller and colleagues found that children's emotional affinity towards nature was a significant predictor of children's willingness for pro-environmental commitment. With regard to direct nature contact, researchers found that children's contact with nature did not have a direct relationship to their willingness for pro-environmental commitment, but rather impacted willingness for pro-environmental commitment indirectly through the development of emotional affinity towards nature. In addition, Müller and colleagues discovered important inter-individual and cross-societal differences. For example, girls were more connected to nature, spent more time in nature, were more aware of environmental risks, and expressed more willingness for pro-environmental commitment than boys, while Lithuanian children had a higher affinity towards nature than German children and children living in rural areas spent more time with nature than those from urban areas. In concluding their article, Müller and colleagues highlight the need for additional research to better understand how nature affinity is developed and effective ways to support children's contact with nature to ensure children build emotional connections and develop a desire to protect nature.

Author Affiliation: Markus Müller is with Catholic University Eichstätt-Ingolstadt in Germany.

Müller, M., Kals, E., & Pansa, R. (2009). Adolescents' emotional affinity toward nature: A cross-sectional study. *Journal of Developmental Processes*, 4(1). This article may be available in a library near you or can be purchased online through the publisher at: <http://www.icdl.com/staging/bookstore/journal/index.shtml>

Key experiences lead to involvement in natural history based professions

James and colleagues investigated natural history professionals' development of nature interests in their childhood, teen, and early adult years in order to better understand what leads children to continue participating in natural history-oriented professions/education/hobbies as a young adult.

Researchers interviewed 51 individuals between the ages of 18 and 35 who were identified as being high achievers in natural history (recreationally, educationally, or professionally) about how their interests developed from childhood to the present. In addition, James and colleagues interviewed 10 individuals who were not outdoor enthusiasts to serve as a comparison group. In analyzing the interviews, researchers coded the data and identified specific domains that were relevant to the development of nature interests. With this information, James and colleagues developed a model of how individuals become involved in natural history professions. The model consists of four stages, each of which has 3 main facets or domains: social mediation and facilitation, play, and exploration. Each of the 4 stages of the model is described briefly below:

- 1) *Direct experiences*—This stage occurs in early childhood and is driven by direct, informal and unstructured experiences with nature (from wildlands to vacant lots). There is a lack of adult supervision or structure and much fantasy play.
- 2) *Emerging formal skills*—This stage occurs in middle childhood and is driven by learning formal outdoor recreation skills and enhancing environmental competencies. Family members provide children with opportunities to learn a range of nature-based recreation activities. In addition, children push their geographic boundaries through exploration.
- 3) *Role awareness*—This stage emerges in middle childhood and the teenage years and is driven by involvement in adult-like nature roles through volunteering or working at camps, nature centers, etc. The emphasis is on further development of social relationships around nature-based activities and a strengthened awareness of environmental vocational roles.
- 4) *Natural history identity formation*—This stage occurs in the teenage years and early adulthood and is focused on the creation of social and professional affiliations based on a view of oneself as an environmental person. By this stage, nature has become a part of the individual's identity.

In contrast to the group of natural history professionals, James and colleagues found that the comparison group had little interaction with natural resources during their life events. In reviewing their findings, researchers highlight the importance of self-directed childhood play, a variety of nature-based recreation and formal nature study opportunities, and interaction with different types of mentors at different times during development. While this study may be limited due to its emphasis on retrospective data and a small sample size, it provides an important perspective on how young adult natural history professionals develop their nature interests. James and colleagues highlight implications of their work for practice, as well as areas for future research.

Author Affiliation: J. Joy James is with Appalachian State University.

James, J. J., Bixler, R. D., & Vadala, C. E. (2010). From play in nature, to recreation then vocation: a developmental model for natural history-oriented environmental professionals. *Children, Youth and Environments, 20*(1). This article is available online at: <http://www.colorado.edu/journals/cye/>