Health & Environment
A National Environmental Education Foundation Program

FACT SHEET
CHILDREN'S HEALTH AND NATURE

Current State of Children's Health


Photo Courtesy of The Audubon Society

Our children may be the first generation at risk of having a shorter lifespan than their parents [1]. Sedentary lifestyle and physical inactivity have contributed greatly to the numerous health problems plaguing today's children. Chronic conditions such as childhood obesity, asthma, attention-deficit disorder, and vitamin D deficiency have all increased over the past few decades [2, 3]. These conditions may lead to pulmonary, cardiovascular and mental health problems in adulthood. Outdoor activity in the natural environment has taken a back seat to television, video games, the computer, and a demanding schoolwork and extracurricular schedule. Many low-income and minority children are often more cut-off from nature due to the 'built environment' around them: poor housing conditions, high-volume traffic, and a lack of parks and green space [4]. While losing contact with the natural environment, today's youth are missing key opportunities for physical activity, stress reduction, attention restoration, and healthy development.

Childhood Obesity

Approximately 17% of children ages 2-19 years are obese and an additional 14.8% are considered overweight [5].[1] According to the Institute of Medicine, childhood obesity has doubled over the past 30 years for preschoolers and adolescents, and more than tripled for children aged 6-11 years old [6].

Disparities in childhood obesity are also rising. Approximately 38.2% of Hispanic children ages 2-19 years are overweight or obese, compared to 29.3% of white children. In addition, 35.9% of African American children ages 2-19 years are overweight or obese [5]. However, prevalence of childhood obesity has increased at all income and education levels [7].

[1] Overweight= BMI ≥ 85th percentile and ≤ 95th percentile; childhood obesity = BMI ≥ 95th percentile. BMI = Body-mass index; calculated using the formula: weight (lb) / [height (in)]^{2} x 703. To calculate BMI, visit http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx.

Obesity-Related Diseases

Type 2 Diabetes

About 3,700 children are newly diagnosed with type 2 diabetes each year [8]. Due to the drastic increase in the prevalence of pediatric diabetes over the past few decades, the definition has changed from "adult-onset" diabetes to type 2 diabetes.

Hypertension

1 in 10 children with a BMI within or above the 95th percentile have hypertension (vs. only 2.6% with a BMI <85th percentile) [14]. Elevated blood pressure in children is also associated with TV viewing, video game, and computer use. [15].

Asthma

Currently 9.4% of children in the US have asthma [9]. Overweight children are at an increased risk for developing asthma and other respiratory problems and for being hospitalized for asthma [10, 11, 12]. Additionally, young children who watch more than 2 hours of TV a day are almost twice as likely to develop asthma at 11.5 years of age compared to those who watch TV for 1-2 hours/day [13].

Cardiovascular Disease

Overweight adolescents are at increased risk of coronary heart disease and earlier death [1]. Most overweight children have at least one risk factor for cardiovascular disease, including higher cholesterol levels, abnormal glucose tolerance, high blood pressure, and elevated triglycerides [16]. 20% of youths aged 2-19 years have at least one abnormal lipid level [17]. The American Academy of Pediatrics recommends screening overweight children for high cholesterol and prescribing cholesterol-lowering drugs if needed [18].

According to the U.S. Surgeon General, overweight adolescents have a 70% chance of becoming overweight or obese adults [19], and even 2-5 year olds with a high BMI are likely to become obese adults [20]. 66% of US adults are currently overweight or obese, and large waist size is associated with increased asthma prevalence and severity, especially in women [21]. Adult health consequences of obesity also include coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, as well as endometrial, breast, prostate, and colon cancers [22]. Adults with obesity also have an increased risk of dementia and Alzheimer's disease [23].

Attention-Deficit/Hyperactivity Disorder (ADD/ADHD)

According to the Centers for Disease Control and Prevention (CDC), ADD/ADHD is a serious public health problem that impacts approximately 9% of children aged 4-17 years [24]. It impairs school performance and socialization and may persist into adulthood [25]. Watching television and playing video games may be associated with increased attention problems in children [26].

Vitamin D Deficiency

70% (~58.4 million) of US children and adolescents have insufficient levels of vitamin D, which can cause rickets and eventually lead to osteoporosis [27, 28]. Additionally, low levels of vitamin D may be associated with increased markers of asthma severity. 28% of children with asthma aged 6 to 14 have insufficient levels of vitamin D [29]. Vitamin D deficiency is also associated with cardiovascular disease, metabolic syndrome, hypertension, diabetes, myocardial infarctions, and peripheral arterial disease [30, 31]. The body must receive at least 10-15 minutes of sunlight exposure twice a week to produce the necessary amount of vitamin D [27].

Nature and Health

Unstructured outdoor play time is important for children's overall well-being. How does nature play a role in children's health? Highlights of published literature supporting the health benefits of the natural environment are presented below.

Nearby Nature: A Buffer of Life Stress Among Rural Children [32]

Childhood stress has become an increasing issue of concern for pediatricians in America. The workload of school and extracurricular activities has the potential to create more stress upon a child, which can affect the child's development. Evidence has shown that the outdoors is a stress reliever to highly stressed children. A study examined whether nearby nature acts as a buffer of life stress among rural elementary school children. The authors determined if the child lived near a natural environment, and then examined the child's self-worth and levels of psychological distress. Contact with nature not only decreased their stress, but higher amounts of exposure to natural environments indicated lower levels of stress in a child.

Coping with ADD: The Surprising Connection to Green Play Settings [33]

An increasing amount of evidence is showing that exposure to natural environments can mitigate a child's attention disorder.[2] Authors of a 2001 study analyzed this concept by surveying parents to compare their child's attentional functioning when engaging in leisure activities in indoor vs. outdoor settings. Results included that children had better attentional functioning after activities in greener settings. The greener the setting, the less severe the symptoms of the child's attention disorder.

A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder. Evidence from a National Study [35]

A follow-up nationwide study published in *The American Journal of Public Health* in 2004 by the same authors examined if "green" settings reduced symptoms of ADHD. Green outdoor after-school and weekend activities were compared to activities that were in built indoor and outdoor settings. They found that "green outdoor activities reduced symptoms significantly more than did activities conducted in other setting, even when matched across all settings." However, this study was not randomized or controlled, and the "green activities" were not uniformly defined. The authors also published a study in *The Journal of Attention Disorders* in 2009 which showed that a 20-minute walk in nature is associated with better concentration in children with ADHD [36]. Further research on this subject will help us better understand the true impact of the natural environment on attention functioning.

Morbidity is Related to a Green Living Environment [37]

A 2009 cross-sectional study investigated the relationship between morbidity and the amount of natural land around a residential environment, which excluded small-scale natural features such as gardens and residential trees. Multivariate logistic regression was used to control for demographic factors, socioeconomic characteristics, and whether the surroundings were urban or rural. The authors found

[2] This evidence is built upon the Attention Restoration Theory, which suggests that the mechanism prone to becoming fatigued after the prolonged or intense use of directed attention can be renewed by contact with nature [34].

24 clusters of disease, and determined that the prevalence rates for 15 of these 24 clusters were lower in environments with more natural environments. This relation was apparent for all seven disease categories, including cardiovascular, musculoskeletal, mental, respiratory, neurological, digestive, and miscellaneous. Depression and anxiety disorder showed the strongest association to the amount of nature in people's living environments, especially in children. Authors also stressed the importance of green space close to home for children and lower socioeconomic groups.

Outdoor Activity Reduces the Prevalence of Myopia in Children [38]

A population-based study published in 2008 determined if near-distance, mid-distance, and outdoor activities were associated with the prevalence of the eye condition myopia in 4,132 children aged 6 and 12. Authors found that higher levels of outdoor time spent was associated with less myopia and increased hyperopic mean refraction in 12 year old participants. Children with high near-distance activity and low outdoor activity had two- to three-fold higher odds of having myopia than normal. Authors concluded that more research is needed in this matter; however, outdoor activity should be promoted by the public health community and included in school curricula.

Children Living in Areas with More Street Trees Have Lower Prevalence of Asthma [39]

An ecological study conducted in New York City has suggested that being exposed to a natural environment may be protective against early childhood asthma. Streets with a high tree density were positively associated with a lower prevalence of early childhood asthma in 4-5 year olds. Further research is currently being conducted to determine the extent to which the trees play a role in the control of pediatric asthma.

The Mental and Physical Health Outcomes of 'Green Exercise' [40]

This study examined the health effects of physical activity while being exposed to various forms of nature. Adult subjects ran on a treadmill while being shown four different themes of pictures: (a) rural pleasant, (b) urban pleasant, (c) rural unpleasant and (d) urban unpleasant photographs (a control group ran without any photographs for comparison). The researchers measured subjects' blood pressure, self-esteem, and mood. The study concluded that the rural and urban pleasant nature picture not only showed a significant reduction in blood pressure, but also a more positive effect on mood. Furthermore, participants in the rural pleasant group had the largest reduction in blood pressure. The authors suggested that "green exercise" not only has a greater effect on blood pressure than exercise alone, but also is beneficial for people's mental health.

Does Participating in Physical Activity in Outdoor Natural Environments Have a Greater Effect on Physical and Mental Wellbeing than Physical Activity Indoors? A Systematic Review [41]

Exercising outdoors in nature may bring additional positive effects on mental wellbeing than exercising indoors. Authors of this 2011 systematic review examined a total of 11 scientific studies comparing the effects of participating in indoor and outdoor activity on mental wellbeing in young adults. Participants engaged in a short walk or run in the outdoor environment and a similar walk or run indoors. Nine out of the 11 trials showed improvement in mental wellbeing from exercising outdoors compared to exercising indoors. Exercising in natural environments was associated with greater feelings of revitalization and positive engagement, decreases in tension, confusion, anger, depression, and increased energy. Participants also reported greater enjoyment and satisfaction with

outdoor activity and declared a greater intent to repeat the activity. Authors stressed the need for further research in this area.

View Through a Window May Influence Recovery from Surgery [42]

Nature has always been known to have a restoring or therapeutic power on humans. There has been evidence showing that people can recover from a surgery or deal with pain better if exposed to a natural environment. A study from in *Science* compared 23 matched pairs of patients who underwent a cholecystectomy (a common type of gall bladder surgery). The post-surgery patients were randomly assigned to either rooms facing a brick building, or a room with a view of a natural environment (trees, grassy field). Investigators found that those facing nature had shorter post-operation stays, less negative comments from nurses, took less analgesics and had decreased amounts of post-operative patients. The study concluded that viewing nature alone can aid in the path to recovery.

Distraction Therapy with Nature Sights and Sounds Reduces Pain During Flexible Bronchoscopy: A Complementary Approach to Routine Analgesia [43]

Natural environments can also act in reducing pain. A randomized controlled trial used distraction therapy (in the form of sights and sounds of nature) in the operating room during a flexible bronchoscopy through conscious sedation. Patients then rated the level of pain and anxiety they experienced during the operation. The authors found that pain control was four to five-folds better for the intervention group than the control groups. The study suggests that clinicians should supplement analgesic medication with an inexpensive, non-invasive method of distraction therapy.

Effect of Exposure to Natural Environment on Health Inequalities: An Observational Population Study [44]

A 2008 study published in *Lancet* investigated if exposure to green space (i.e. parks, forests, river creeks, play fields) is a determinant of good health. Authors classified more than 40 million people from England based on level of income and access to green space. All-cause, circulatory, lung cancer and intentional self-harm mortality records were obtained from 2001-2005 to determine if there was an association with income deprivation and exposure to green space. The major finding was that the group living in the greenest areas had the lowest level all-cause mortality and mortality due to circulatory diseases related to income deprivation. The authors suggested that exposure to natural environments could play a vital role in reducing health inequalities.

Neighborhood Greenness and 2-Year Changes in Body Mass Index of Children and Youth [45]

A retrospective cohort study appearing in the December 2008 issue of *The American Journal of Preventive Medicine* followed low-income children ages 3-16 years for two years. Authors calculated their change in BMI and measured the amount of green space in each child's neighborhood using satellite images. After adjusting for potential variables such as age and gender, it was found that higher greenness was associated with lower odds of increased change in BMI (OR: 0.87, 95% CI: 0.79-0.97). Authors suggested that efforts to get children outside and engaged in healthy behaviors should be promoted as a means to help combat childhood obesity.

The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds [46]

The American Academy of Pediatrics (AAP) released a Clinical Report in 2007 on the importance of free play in the development of healthy children. Free play aids in physical, emotional, cognitive and social development of a child. They stated that the benefits of play include healthy brain development, a more developed imagination, dexterity, emotional strength, and physical strength. The AAP suggests to parents and pediatricians to allow children to have more unstructured play.

Active Healthy Living: Prevention of Childhood Obesity Through Increased Physical Activity [47]

Allowing children free, unstructured outdoor play is an important way to help them get physically active. The AAP issued a policy statement in 2006 to pediatric health care providers on ways to increase physical activity in children and adolescents. The authors stated that lifestyle-related physical activity, as opposed to aerobics or calisthenics, is critical for sustained weight loss in children, and recommended free, unorganized outdoor play as a method of physical activity. Infants and toddlers should be allowed outdoor physical activity, unstructured free play, and exploration. The AAP encourages parents to get their children outside as much as possible.

A Prospective Examination of Children's Time Spent Outdoors, Objectively Measured Physical Activity and Overweight [48]

This three-year cohort study measured the physical activity and BMI in children who spent time outdoors throughout the week. The authors found that each additional hour spent outdoors was associated with an extra 27 minutes per week of moderate and vigorous physical activity. Furthermore, the prevalence of overweight among children at follow-up was 27-41% lower among those spending more time outdoors. The authors suggested that encouraging children to spend more time outdoors may be an effective strategy for increasing physical activity and preventing childhood obesity.

Grounds for Movement: Green School Grounds as Sites for Promoting Physical Activity [49]

"Green" school grounds may affect the quantity and quality of physical activity among elementary school children. Recently, schools have engaged in efforts to emphasize these features in an effort to encourage children to be more active and imaginative. An evaluation of these initiatives was conducted at 59 schools across Canada by surveying teachers, parents, and administrators. The survey evaluated to what extent the "green" features in their school yards influence physical activity of students. 70% of respondents indicated that the initiative resulted in increased light-moderate physical activity, and 50% also reported that their "green" school ground promoted more vigorous activity. Respondents also indicated that their school grounds now appeal to a greater breadth of student interests and support a wider variety of play activities.

Public Parks and Physical Activity Among Adolescent Girls [50]

This cross-sectional study examined the association between park proximity, park type, and park features and physical activity in adolescent girls. 1,556 sixth grade girls were randomly selected from 6 middle schools across the country and wore accelerometers to measure moderate-to-vigorous physical activity. Each park in a half-mile radius around each girl's home was associated with 17 more minutes of nonschool, moderate-to-vigorous physical activity over a 6 day period.

Higher levels of physical activity were associated with park features such as walking paths, running tracks, playgrounds, and basketball courts and safety features like streetlights and floodlights. Other studies have also shown that living near a park increases physical activity [51, 52].

Recommendations

Centers for Disease Control and Prevention:

The CDC encourages children to get at least 60 minutes of physical activity most days of the week, preferably daily. Because nature has the potential to improve one's physical, mental, and social health, the CDC advises children to engage in healthy outdoor activities in nature and parks. For more information, visit: http://www.cdc.gov/Features/ParksAndTrails/. The CDC also provides a toolkit about the important role of communities, schools, and families in promoting physical activity for youth, available at: http://www.cdc.gov/healthyyouth/physicalactivity/guidelines.htm.

U.S. Department of Health and Human Services:

The 2008 Physical Activity Guidelines advise children to be physically active at least one hour a day through age-appropriate, enjoyable activities such as hiking, bicycling, climbing trees, or going to the park. These guidelines can improve children's cardiorespiratory fitness, cardiovascular and metabolic health, bone health, and body composition. The 2008 Physical Activity Guidelines are available at: http://www.health.gov/PAGuidelines/guidelines/default.aspx. The *Surgeon General's Vision for a Healthy and Fit Nation 2010* Report recommends family-based physical activities and that children have scheduled time to play [53]. The report is available at: http://www.surgeongeneral.gov/library/obesityvision/obesityvision2010.pdf.

American Academy of Pediatrics:

The American Academy of Pediatrics (AAP) recommends that pediatricians promote free, unstructured play and discourage excessive passive entertainment such as TV, internet, and video games to 2 hours a day [54]. AAP also recommends that children be physically active at least 60 minutes/day. In addition, parents are advised to record the number of times each week that their child spends outdoors for at least 30 minutes [47]. Furthermore, AAP recommends that pediatricians ask patients and families about opportunities for recreational and incidental physical activity in nearby parks, playgrounds, or open spaces and advocate for environmental improvements that will promote physical activity [4]. The Clinical Report on the importance of play for children is available at: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;119/1/182; the Policy Statement on increasing physical activity in children is available at: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;117/5/1834; and the policy statement on the built environment and physical activity is available at http://aappolicy.aappublications.org/cgi/reprint/pediatrics;123/6/1591.pdf.

American Medical Association and American College of Sports Medicine:

A program was launched by the American Medical Association and the American College of Sports Medicine to encourage physicians to prescribe exercise to their patients. Two-thirds of patients from a survey suggested that they would be more inclined to exercise if told by a physician. The program recommends 30-40 minutes of physical activity, five days a week. For more information, visit http://www.exerciseismedicine.org/.

Conclusion

There is a strong body of evidence attributing improved health with physical activity. In addition, there is evidence suggesting that nature specifically can improve attention and other psychological aspects of health. Playing in nature can positively impact children's health and well-being. We encourage parents and caregivers to get your children out into the natural environment. Together we can teach them how to protect their health and the environment.

"Time in nature is not leisure time; it's an essential investment in our children's health." Richard Louv, author of Last Child in the Woods [55]

Sources

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For a complete literature review of the scientific evidence for the physical and mental health benefits of nature, please see:

Using Nature and Outdoor Activity to Improve Children's Health- McCurdy, Winterbottom, Mehta, Roberts. *Current Problems in Pediatric and Adolescent Health Care* 2010;40(5):102-117.
http://www.cppah.com/

For more information on NEEF's Children and Nature Initiative: Prescriptions for Outdoor Activity, please visit: www.neefusa.org/health/children_nature.htm

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