



# Children & Nature

Being active in nature makes kids healthier.

Children living within a 1/2 mile of a park are more likely to have higher levels of physical activity.

There are more than 20,000 parks and 11,000 playgrounds—totaling over 1.5 million acres—in cities across the U.S.

Exposure to nature can reduce stress levels by as much as 28% in children.

Children living within 2/3 mile of a park with a playground can be 5 times more likely to have a healthy weight.

Even a 20-minute walk in nature can help children with attention deficit hyperactivity disorder (ADHD) concentrate better.

AAP recommends children be physically active for at least 60 minutes throughout a day and limit time with electronic media to 2 hours per day.

Time spent outdoors is predictive of higher levels of physical activity in children.

Children have lost 25% of playtime and 50% of unstructured outdoor activity over recent decades.

Kids spend more than 7 hours a day with various electronic media.

Parents, friends and family are the most influential to youth participation in outdoor activities.

More than 1 in 3 children in the U.S. are overweight or obese. Minority and low-income children are disproportionately affected.

Outdoor exercise improves mental & physical well-being more so than indoor activity.

3,600 youth are diagnosed each year with type-2 diabetes for which obesity is a major risk factor.

Children who spend more time outdoors are less likely to be overweight by 27-41%.

7 million children in the U.S. have asthma and overweight children are at higher risk.

Nature Deficit Disorder was coined by author Richard Louv in 2005 to describe how children are spending less time outdoors and its impacts.

## Sources:

- American Academy of Pediatrics
- Centers for Disease Control and Prevention
- Cleland V, et al. Int J Obesity 2008; 32:1685-93.
- Cohen DA. Pediatrics 2006; 118, 1381-1389.
- J. Thompson Coon, et al. Environ. Sci. Technol. 2011; 45 (5), 1761-1772.
- Juster FT et al. Changing Times of American Youth: 1981-2003. Univ. of Michigan, 2004.
- Louv, Richard. (2005). Last Child in the Woods. Chapel Hill, NC: Algonquin Books.
- McCurdy LE et al. Current Problems in Pediatric & Adolescent Health Care 2010; 40(5):101-118.
- Ogden CL, et al. J. of the American Med. Assoc. 2010; 303 (3): 242-249.
- Rideout VJ et al. Kaiser Family Foundation Report, 2010.
- Schachter LM et al. Thorax 2001; 56:4-8.
- Taylor AF, Kuo FE. J. Atten. Disord. 2009; 12:402.
- The Outdoor Foundation. Special Report on Youth, 2010.
- The Trust for Public Land
- Wells NM & Evans GW. Environ. and Behavior 2003; 35:311-330.

Find out more: NEEFusa.org



## FACT SHEET ADULT HEALTH AND NATURE

### Current State of Adult Health

Adult populations in the United States are burdened by chronic diseases that lead to decreased quality of life, increased health care costs, and preventable morbidity and mortality. Many of these illnesses have a strikingly disproportionate impact on minority populations and those with low socioeconomic status.

More than one third of the population, or 149 million U.S. adults over age 20, is overweight or obese.<sup>1,2</sup> Obesity is associated with increases in mortality rates and risk for widespread chronic illnesses, including type 2 diabetes, hypertension, high cholesterol, heart disease, stroke, respiratory illnesses, and some cancers.<sup>1,2</sup> Type 2 diabetes is associated with shorter life expectancy and minority adults are



twice as likely as white adults to be affected.<sup>3</sup> More than 60 million Americans have hypertension and high cholesterol, much of which is uncontrolled.<sup>4</sup> Cardiovascular disease affects 1 in 3, or more than 83 million, and heart attack and stroke are the first and third leading causes of death in the United States.<sup>4</sup> Death rates are 37% higher among African Americans than whites and American Indian and Alaska natives have the highest percentage of premature death associated with cardiovascular disease.<sup>4</sup> Asthma is another chronic illness on the rise that affects over 18 million, or 1 in 12, adults.<sup>5</sup> Multi-race and black adults, women of all races, individuals with lower income and education levels, and those who are overweight are more likely to have asthma.<sup>5,6</sup> Mental illness is also prevalent, affecting 25% of all U.S. adults, and can adversely affect the outcomes of other chronic illnesses.<sup>7</sup>

Lifestyle modification with medical management, diet, physical activity, and behavior therapy, including stress management, are recommended for the control of these conditions.<sup>3,4</sup> Nature has long been used in cultures around the world as a form of healing and a way to foster good health. Research demonstrates that contact with nature benefits people of all ages and can positively impact health. Access to nature has been related to better health, greater physical and mental well-being, restoration from stress, and greater social connectivity.

## Nature and Health

Connection with the natural environment is beneficial for the body and can positively influence health. The natural environment can aid in the healing process and potentially prevent negative outcomes for hospitalized patients. One study looked at the view outside the window of twenty three matched pair post-op cholecystectomy patients. Those facing natural environments, compared to a brick wall, were shown to have shorter hospital stays, received fewer negative evaluative comments from nurses, and took less pain medication.<sup>8</sup> Another study looked at using distraction with sights and sounds of nature during flexible bronchoscopy with conscious sedation to reduce pain. Researchers found a four to five-fold increase in pain control in intervention groups compared to control groups.<sup>9</sup> Studies from Japan connect *Shinrin-yoku*, or bathing the senses in the forest environment, with health benefits when compared to city settings. This immersion in nature is shown to lower pulse rate and blood pressure, and decrease sympathetic nerve activity, the body's natural stress response.<sup>10</sup> One study specifically connected forest bathing with a reduction in blood pressure and inflammation in the elderly.<sup>11</sup> Large epidemiological studies in Canada, Denmark, Japan, and the Netherlands that control for potential socioeconomic and demographic factors show that having access to nature lowers rates of cardiovascular disease, stroke, obesity, and depression<sup>12-16</sup> and is associated with better immune system functioning<sup>17</sup> and fewer health problems.<sup>18</sup>

## Physical Activity and Well-Being in Nature



Physical activity promotes health and can have a substantial impact on the state of chronic disease. Life expectancy, obesity, type 2 diabetes, cardiovascular disease, mental illness, and even quality of sleep have all been shown to improve when individuals increase physical activity. In addition to the health disparities that exist for these diseases, data shows that some minority groups are less likely to get the exercise needed to meet recommended levels.<sup>19</sup>

A number of studies connect physical activity in outdoor natural environments with greater physical and mental well-being. Across socioeconomic levels, people are more likely to walk if they live near parks and a positive association exists between physical activity and access to green space.<sup>20-23</sup> A large study in England revealed that those living closer to parks are more likely to achieve recommended levels of physical activity.<sup>24</sup> Epidemiologic studies indicate that an active lifestyle protects brain functioning in the elderly and can delay onset of dementia and Alzheimer's Disease.<sup>25,26</sup> Adults getting active by volunteering at least 200 hours over a four year study were 40% less likely to develop high blood pressure.<sup>27</sup> Another study found that even looking out a window at natural elements or settings has been shown to increase aspects of well-being and satisfaction with where people live.<sup>28</sup> It has been shown that looking at nature pictures while

running on a treadmill yields a significant improvement in blood pressure and a positive effect on mood and self-esteem.<sup>29</sup> Furthermore, exercise within a natural environment, when compared to indoor exercise, is associated with decreases in tension, confusion, anger, and depression.<sup>30</sup> Study participants with major depressive disorders have been shown to have increases in mood and a significant increase in memory span after a nature walk compared to an urban walk.<sup>31</sup> Researchers in Edinburgh looked at EEG recordings while participants took a 25 minute walk and results showed evidence of lower frustration, engagement, and arousal, and higher meditation when moving into green space.<sup>32</sup> Another study took participants backpacking in the wilderness for 4-6 days without access to electronic technology and found that creativity and problem solving increased by 50%, supporting the positive effects of immersion in a natural setting.<sup>33</sup>

### Nature as a Stress Reducer

Some stress can be a positive and motivating force. Chronic stress, however, can have negative impacts on health and exacerbate illness. Many studies associate access to nature with reduced levels of stress. Studies have shown that participants report less stress the more often they visit green spaces and have access to nature.<sup>21,34,35</sup> When residents of public housing have views of trees rather than entirely built surroundings, they show greater capacity to cope with stress, better conflict management, and lower levels of family aggression.<sup>36-38</sup> One study utilized salivary cortisol sampling to look at green space and stress in deprived communities. Researchers found a significant positive correlation between decline in cortisol and increased quality of green space in the living environment of deprived communities.<sup>39</sup> Another study found decreases in cortisol levels and mood enhancement with 30 minutes of outdoor gardening, further highlighting nature as a valuable resource for health promotion.<sup>40</sup>

### Social Interaction in Nature

Positive social connectivity can improve the lives and health of individuals and the communities they live in. Social support provides a buffer against stress, anxiety, and depression, which can all adversely affect chronic illness.

The natural environment helps to connect people. One study found that 83% more participants engaged in social activity in greenspace, as opposed to barren space.<sup>41</sup> Participation in community gardens is associated with reduced social isolation, a sense of collective efficacy, and increased social networks, social involvement, and neighborhood attachment.<sup>42-45</sup> Among public housing residents, having green views predicts a



stronger sense of community and more social ties with neighbors and greener surroundings are associated with a greater sense of safety.<sup>37,38</sup>

## **Recommendations**

### **U.S. Department of Health and Human Services**

The 2008 Physical Activity Guidelines advise adults to be physically active with aerobic and muscle-strengthening activities. Recommended aerobic activity may consist of at least 2 hours and 30 minutes of moderate activity, 1 hour and 15 minutes of vigorous activity, or a combination of both every week.<sup>46</sup> Muscle strengthening activities should be done at least 2 days per week to work all major muscle groups.<sup>46</sup> Active adults are less likely to develop many chronic illnesses and have a healthier body size and composition. Both men and women of all races and ethnicities have been shown to benefit from the recommended activity levels. The 2008 Physical Activity Guidelines are available at: [www.health.gov/PAGuidelines/guidelines/default.aspx](http://www.health.gov/PAGuidelines/guidelines/default.aspx).

### **Centers for Disease Control and Prevention:**

The CDC encourages adults to participate in both aerobic and strengthening activities several days per week for health benefits. The CDC provides strategies for all ages to get active, available at: [www.cdc.gov/physicalactivity/index.html](http://www.cdc.gov/physicalactivity/index.html). The CDC also advises adults to engage in healthy outdoor activity, such as walking and gardening. For more information, visit [www.cdc.gov/features/VitalSigns/Walking](http://www.cdc.gov/features/VitalSigns/Walking) and [www.cdc.gov/Features/gardeningtips](http://www.cdc.gov/Features/gardeningtips).

### **Surgeon General:**

The *Surgeon General's Vision for a Health and Fit Nation 2010* report recommends walking outdoors in their communities to promote better health. Americans are encouraged to add walking to daily routines to promote regular physical activity. For more information, visit: [www.surgeongeneral.gov/initiatives/walking/index.html](http://www.surgeongeneral.gov/initiatives/walking/index.html).

### **American College of Sports Medicine:**

Exercise is Medicine is a program coordinated by the American College of Sports Medicine to encourage physicians to prescribe, assess, and review physical activity plans for all patients at every visit. Physical activity is recommended to help prevent and manage chronic illness. It has been suggested that patients would be more inclined to exercise if told by a physician. Recommendations on how to exercise safely with a variety of health conditions is provided. For more information, visit [www.exerciseismedicine.org](http://www.exerciseismedicine.org).

## **Conclusion**

The power of nature cannot be underestimated. Evidence suggests that nature can improve many aspects of health and decrease the burden of chronic disease. The benefits of nature should be

emphasized by health practitioners, policy makers, housing agencies, and natural resource departments. Access to natural areas and green spaces should be a priority for all people, no matter their age, socioeconomic status, or living environment.

## References

- [1] Ogden C, et al. (2012). Prevalence of Obesity in the United States, 2009-2010. National Center for Health Statistics: NCHS Data Brief No. 82.
- [2] American Heart Association. (2012). Heart Disease and Stroke Statistics-2012 Update : A Report From the American Heart Association. *Circulation*, 125:e2-e220.
- [3] Centers for Disease Control and Prevention. (2011). Diabetes Successes and Opportunities for Population-based prevention and control.
- [4] Centers for Disease Control and Prevention. (2011). Heart Disease and Stroke Prevention: Addressing the nation's leading killers.
- [5] Centers for Disease Control and Prevention. (2011). Asthma's Impact on the Nation.
- [6] Von Behren J, et al. (2009). Obesity, waist size and prevalence of current asthma in the California Teachers Study cohort. *Thoracic*, 64:889-893.
- [7] Centers for Disease Control and Prevention (2011). Mental Illness Surveillance Among U.S. Adults.
- [8] Ulrich RS (1984). View through a window may influence recovery from surgery. *Science*, 224(4647):420-421.
- [9] Diette GB, et al. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy: a complementary approach to routine analgesia. *Chest*, 123(3):941-948.
- [10] Park B, et al. (2009). The physiological effects of Shinrin-yoku (taking in the forest atmosphere or forest bathing): evidence from field experiments in 24 forests across Japan. *Environmental Health and Preventative Medicine*, 15:18–26.
- [11] Mao G, et al. (2012). Therapeutic effect of forest bathing on human hypertension in the elderly. *Journal of Cardiology*, 60(6): 495-502.
- [12] de Vries S, et al. (2003). An exploratory analysis of the relationship between greenspace and health. *Environmental and Planning A*, 35:1717-1731.
- [13] Maas J, et al. (2009). Morbidity is related to a green living environment. *Journal of Epidemiology and Community Health*, 63(12):967-973.
- [14] Nielsen TS, Hansen KB. (2007). Do green areas affect health? Results from a Danish survey on the use of green areas and health indicators. *Health and Place*, 13(4):839-50.
- [15] Mitchell R, Popham F. (2008). Effect of exposure to natural environment on health inequalities. *Lancet*, 372(9650):1655-1660.
- [16] Villeneuve PJ, et al. (2012). A cohort study relating urban green space with mortality in Ontario, Canada. *Environmental Research*, 115:51-8.
- [17] Li Q. (2010). Effect of forest bathing trips on human immune function. *Environmental Health and Preventive Medicine*, 15:9-17.
- [18] van den Berg AE, et al. (2010). Green space as a buffer between stressful life events and health. *Social Science and Medicine*, 70:1203-1210.
- [19] Centers for Disease Control and Prevention. (2013). Quick Stats. Morbidity and Mortality Weekly Report , 26 (31): 635.
- [20] Kjellgren A, Buhrkall H.(2010). A comparison of the restorative effect of a natural environment with that of a simulated natural environment. *Journal of Environmental Psychology*, 30(4):464-472.
- [21] Fan Y, Das KV, Chen Q. (2011). Neighborhood green, social support, physical activity, and stress. *Health and Place*, 17:1202-1211.
- [22] Mytton OT, et al. (2012). Green space and physical activity: an observational study using Health Survey for England data. *Health Place*, 18(5):1034-41.
- [23] Astell-Burt T, et al. (2013). Green space is associated with walking and moderate-to-vigorous physical activity (MVPA) in middle-to-older-aged adults: findings from 203 883 Australians in the 45 and up study. *British Journal of Sports Medicine*. 2013 Apr 30. [Epub ahead of print].
- [24] Coombes E, et al. (2009). The relationship of physical activity and overweight to objectively measured green space accessibility and use. *Social Science & Medicine*. 2010 Mar;70(6):816-22.
- [25] Rolland Y, et al. (2008). Physical activity and Alzheimer's Disease: From prevention to therapeutic perspectives. *Journal of the American Medical Directors Association*, 9: 390–405.
- [26] Larson E, et al. (2006). Exercise is associated with reduced risk for incident dementia among persons 65 years of age and older. *Annals of Internal Medicine*, 144, 73–81.

- [27] [http://www.eurekalert.org/pub\\_releases/2013-06/cmu-vrr061213.php](http://www.eurekalert.org/pub_releases/2013-06/cmu-vrr061213.php)
- [28] Kaplan R. (2001). The nature of the view from home: Psychological benefits. *Environmental Behavior*; 33(4): 507-542.
- [29] Pretty J, et al. (2005). The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research*, 15(5):319-37.
- [30] Coon JT, et al. (2011). 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. *Environmental Science & Technology*, 45, 1761–1772.
- [31] Berman MG, et al. (2012). Interacting with nature improves cognition and affect for individuals with depression. *Journal of Affective Disorders*, 140(3):300-5.
- [32] Aspinall P, et al. (2013). The urban brain: analysing outdoor physical activity with mobile EEG. *British Journal of Sports Medicine*. [Epub ahead of print].
- [33] Atchley RA, et al (2012). Creativity in the wild: improving creative reasoning through immersion in natural settings. *PLoS One*, 7(12):e51474.
- [34] Stigsdotter U, et al. (2010). Health promoting outdoor environments - Associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey. *Scandinavian Journal of Public Health*, 38: 411.
- [35] Matsuoka R, Sullivan W. (2011). Urban nature: Human psychological and community health. In: Douglas I, Goode D, Houck M, Wang R, eds. *The Routledge Handbook of Urban Ecology*. Abingdon, UK: Routledge; 408-423.
- [36] Bratman GN, et al. (2012). The impacts of nature experience on human cognitive function and mental health. *Annals of the New York Academy of Sciences*, 1249:118-136.
- [37] Kuo FE. (2001). Coping with poverty--impacts of environment and attention in the inner city. *Environment and Behavior*, 33(1):5-34.
- [38] Kuo FE, Sullivan WC. (2001). Aggression and violence in the inner city--effects of environment via mental fatigue. *Environment and Behavior*, 33(4):543-571.
- [39] Thompson C, et al. (2012). More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. *Landscape and Urban Planning*, 105: 221–229.
- [40] Van den berg A, Custers M. (2011). Gardening Promotes Neuroendocrine and affective restoration from stress. *Journal of Health Psychology*, 16(1):3-11.
- [41] Sullivan W, et al. (2004). The Fruit of Urban Nature: Vital Neighborhood Spaces. *Environment and Behavior*, 36(5):678-700.
- [42] Alaimo K, Reischl TM, Ober-Allen J. (2010). Community gardening, neighborhood meetings and social capital. *Journal of Community Psychology*, 38(4):497-514.
- [43] Litt JS, et al. (2011). The influences of social involvement, neighborhood aesthetics and community garden participation on fruit and vegetable consumption. *The American Journal of Public Health*, 101:1466-1473.
- [44] Teig E, et al. (2009). Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens. *Health and Place*, 15:1115-1122.
- [45] Comstock N, et al. (2010). Neighborhood attachment and its correlates: Exploring neighborhood conditions, collective efficacy and gardening. *Journal of Environmental Psychology*, 30:435-442.
- [46] U.S. Department of Health and Human Services. (2008). 2008 Physical Activity Guidelines for Americans.



## FACT SHEET CHILDREN'S HEALTH AND NATURE

### Current State of Children's Health

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].<sup>1</sup> 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].

---

<sup>1</sup> Overweight= BMI  $\geq$  85<sup>th</sup> percentile and  $\leq$  95<sup>th</sup> percentile; childhood obesity = BMI  $\geq$  95<sup>th</sup> percentile. BMI = Body-mass index; calculated using the formula: weight (lb) / [height (in)]<sup>2</sup> 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.

### **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].

### **Hypertension**

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

### **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.<sup>2</sup> 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

---

<sup>2</sup> 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, AAP issued a policy statement about the crucial role of recess in school [55]. AAP states that recess is a necessary break for children during the school day to provide a mental rest and to optimize a child's social, emotional, physical, and cognitive development. Children are more attentive and have better cognitive performance after a recess break. Recess also contributes to the recommended 60 minutes of activity per day. AAP recommends that 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].

### **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 [56]*

## Sources

- [1] Ludwig DS (2007). *New England Journal of Medicine*, 357(23): 2325-27.
- [2] Perrin JM, Bloom SR & Gortmaker SL (2007). *Journal of the American Medical Association*, 297(24): 2755-59.
- [3] Mithal DA, et al (2009). *Osteoporosis International*, 20:1807-1820.
- [4] Committee on Environmental Health (2009). *Pediatrics*, 123(6):1591-1598
- [5] Ogden CL, et al (2010). *Journal of the American Medical Association*, 303 (3): 242-249.
- [6] The Institute of Medicine (2005). Preventing Childhood Obesity: Health in the Balance.
- [7] Ogden CL, et al (2010). National Center for Health Statistics: NCHS Data Brief No. 51.
- [8] Centers for Disease Control and Prevention (2008). National Diabetes Fact Sheet, 2007.
- [9] Centers for Disease Control and Prevention (2008). National Center for Health Statistics: Asthma.
- [10] Schachter LM (2001). *Thorax*, 56(1):4-8.
- [11] Bender B, et al (2007). *Pediatrics*, 120:805-13.
- [12] Scholtens S, et al (2009). *Journal of Allergy and Clinical Immunology*, 123(6):1312-1318.
- [13] Sherriff A, et al (2009). *Thorax*, 64:321-5.
- [14] Sorof JM, et al (2004). *Pediatrics*, 113(3):475-82.
- [15] Martinez-Gomez, et al (2009). *Archives of Pediatrics & Adolescent Medicine*, 163(8):725-730.
- [16] Dietz WM (1998). *Pediatrics*, 101(3):518-525.
- [17] Centers for Disease Control and Prevention (2010). Prevalence of Abnormal Lipid Levels Among Youths.
- [18] Daniels SR, Greer FR & the Committee on Nutrition (2008). *Pediatrics*, 122(1):198-208.
- [19] Office of the Surgeon General (2007). Overweight and Obesity: Health Consequences.
- [20] Freedman DS, et al (2005). *Pediatrics*, 115:22-27.
- [21] Von Behren J, et al (2009). *Thorax*, 64:889-893.
- [22] National Institutes of Health (1998). *Obesity Research*, 6(2):51S-209S.
- [23] Kivipelto M, et al (2005). *Archives of Neurology*, 62:1556-1560.
- [24] Pastor PN & Reuben CA (2008). *Vital Health Statistics*, 10(237):1-14.
- [25] Centers for Disease Control and Prevention (2009). Attention Deficit/Hyperactivity Disorder (ADHD).
- [26] Swing EL, et al (2010). *Pediatrics*, 126 (2): 214-221.
- [27] Brender E, Burke A, & Glass RM (2005). *Journal of the American Medical Association*., 294(18):2386.
- [28] Kumar J, et al (2009). *Pediatrics*, 124(3):e362-e370.
- [29] Brehm JM, et al (2009). *American Journal of Respiratory Critical Care Medicine* 179:765-771.
- [30] Reis JP, et al (2009). *Pediatrics*, 124(3):e371-e379.
- [31] Maki KC, et al (2009). *Journal of Clinical Lipidology*, 3:289-296.
- [32] Wells NM & Evans GW (2003). *Environment and Behavior*, 35(3):311-330.
- [33] Taylor AF, Kuo FE & Sullivan WC (2001). *Environment and Behavior*, 33(1):54-77.
- [34] Kaplan S (1995). *Journal of Environmental Psychology*, 15:169-182.
- [35] Kuo FE & Taylor AF (2004). *The American Journal of Public Health*, 94(9):1580-86.

- [36] Taylor AF & Kuo FE (2009). *Journal of Attention Disorders*, 12(5):402-409.
- [37] Maas J, et al (2009). *Journal of Epidemiology and Community Health*, 63:967-973
- [38] Rose KA, et al (2008). *Ophthalmology*, 115(8): 1279-1285.
- [39] Lovasi GS, et al (2008). *Journal of Epidemiology and Community Health*, 62:647-649.
- [40] Pretty J, et al (2005). *International Journal of Environmental Health Research*, 15(5):319-37.
- [41] Coon JT, et al (2011). *Environmental Science & Technology*, DOI: 10.1021/es102947t.
- [42] Ulrich RS (1984). *Science*, 224(4647):420-421.
- [43] Diette GB, et al (2003). *Chest*, 123(3):941-8.
- [44] Mitchell R & Popham F (2008). *Lancet*, 372:1655-60.
- [45] Bell JF, Wilson JS, Liu GC (2008). *American Journal of Preventive Medicine*, 35(6):547-533.
- [46] Ginsburg KR, et al (2007). *Pediatrics*, 119(1):182-191.
- [47] Council on Sports Medicine and Fitness and Council on School Health (2006). *Pediatrics*, 117(5):1834-1842.
- [48] Cleland V, et al (2008). *International Journal of Obesity*, 32:1685-1693.
- [49] Dymont JE & Bell AC (2008). *Health Education Research*, 23(6):952-962.
- [50] Cohen DA, et al (2006). *Pediatrics*, 118(5):e1381-e1389.
- [51] Cohen DA, et al (2007). *American Journal of Public Health*, 97(3):509-514.
- [52] Roemmich JN, et al (2006). *Preventive Medicine*, 43:437-441.
- [53] U.S. Department of Health and Human Services (2010). The Surgeon General's Vision for a Healthy and Fit Nation.
- [54] Committee on Public Education (2001). *Pediatrics*, 107(2):423
- [55] Council on School Health (2013). *Pediatrics*, 131(1):183-188
- [56] Louv R (2005). *Last Child in the Woods*. Algonquin Books, Chapel Hill, North Carolina.

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/article/S1538-5442%2810%2900044-1/abstract>

**For more information on NEEF's Children and Nature Initiative: Prescriptions for Outdoor Activity, please visit:**  
[www.neefusa.org/health/children\\_nature.htm](http://www.neefusa.org/health/children_nature.htm)