

Nature Deficit and Health in the Pediatric Population; a Critical Appraisal

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Abstract

Background

Nature Deficit Disorder is a term coined by Richard Louv in his 2005 book *Last Child in the Woods*. It describes the costs of decreased exposure to nature including diminished use of the senses, attention difficulties, and higher rates of physical and emotional illnesses. Many chronic health conditions in the pediatric population are thought to correlate with a decrease in "green play" i.e. free play in nature. Some of these conditions include obesity, asthma, attention deficit/hyperactivity disorder, depression and anxiety. In the present paper, the literature on the role nature plays in child and adolescent health and well-being is investigated. It is hypothesized that an increase in exposure to nature would correlate with better health outcomes.

Methods

A literary search was conducted on OvidSP. This search was completed using the mesh terms "Nature" and "Health" and/or "Wellbeing". 22 papers resulted. Only papers pertaining to the pediatric population (including adolescents) were selected. The focus of the papers selected was from a largely public health background and two of the articles comment on policy recommendations. This paper will objectively discuss common themes found in the reviewed papers, including relevant theory and contrary concepts.

Results

It has been well established in literature that physical activity results in better health outcomes in both the pediatric and adult populations. Recent studies have shown that exposure to nature increases childhood activity levels, decreases BMI, increases concentration levels and has

a positive impact on symptoms of ADHD. A healthy trajectory in childhood in turn leads to better adult health outcomes, and potential healthcare savings. However, there remain large gaps in research detailing what specific interventions result in what specific health outcomes.

Interpretation

Increasing childhood exposure to nature results in healthier, more active children. This directly translates into healthier, more active adults. A multipronged approach is the most effective to attain these goals, including government policy, urban planning and health care recommendations. Further research is needed to guide policymakers to target resources to interventions that have specific outcomes for specific target groups.

Introduction

According to Richard Louv, author of *Last Child in the Woods*, nature deficit leads to "diminished use of the senses, attention difficulties and higher rates of physical and emotional illness."¹ The replacement of green play with screen time and demanding school schedules has been shown to cause obesity, lack of socialization, attention disorders and poor academic performance. This change has promoted physical inactivity, increased chronic disease and has negative social and psychological ramifications. Childhood obesity rates have doubled for children ages 6-11 and tripled for adolescents in just two decades. More than 60 percent of overweight children ages 5-10 have at least one risk factor for cardiovascular disease and 25 percent have two or more. In addition, children who are overweight before the age of 8 tend to become overweight adults (Godbey, 2009). Obesity is linked to many negative health consequences in the adult population, both physically and emotionally. A dialogue has emerged in both the public health and the environmental education communities about the benefits of nature for children. A growing body of evidence has suggested that exposure to nature may directly benefit health and that children who spend time outdoors are more active. If integrated into pediatric care, outdoor activity in natural environments may have the potential to improve children's mental health and physical well-being.

¹ Louv, Richard. (2005) *Last Child in the Woods: Saving our Children from Nature Deficit Disorder* Chapel Hill, NC: Algonquin Books of Chapel Hill.

Research Question

This paper seeks to critically appraise four literature reviews and one systemic review and meta-analysis on the role nature plays in child and adolescent health and wellbeing. The focus is largely within the pediatric population, however conclusions presented in the reviewed papers on the adult population were not excluded. It is hypothesized that an increase in exposure to nature would correlate with better health outcomes.

Methods

The papers included in the review have been drawn from a range of sources including relevant electronic databases, peer-reviewed journals and grey literature. A literary search was conducted on OvidSP. This search was completed using the mesh terms "Nature and "Health" and/or "Wellbeing", resulting in 22 papers. Articles were also searched for using web search engines. Only papers pertaining to the pediatric population (including adolescents) were selected. The focus of the papers selected was primarily from a public health background and two of the articles comment on policy recommendations. The five papers selected were then objectively discussed, focusing on common themes, including relevant theory and contrary concepts. Each paper was critically appraised for validity and conclusions were drawn from the presented evidence.

Results

Health Benefits of Physical Activity and Natural Environments

The positive impact of physical activity on chronic disease has been extensively researched in literature. Health Canada states that "physical activity improves health and well-

being. It reduces stress, strengthens the heart and lungs, increases energy levels, helps you maintain and achieve a healthy body weight and it improves your outlook on life".² Indeed incorporating regular exercise into a daily routine is recommended by family doctors nationwide, with the Society for Exercise Physiology recommending evidence-based physical activity guidelines. All of the papers reviewed emphatically agree with this evidence.

There is, more recently, a growing body of evidence that indicates time spent outdoors is associated with increased physical activity, which in turn is associated with better health outcomes. There are also a growing number of studies which suggest exposure to nature may directly benefit health. Townsend et al positively reviewed research on the physiological health benefits of simple activities and nature exposure. For example, they found evidence from different studies that gardening reduces the risk of cardiovascular disease, reduces HDL cholesterol levels in elderly men, improves the health of diabetes patients, and reduces the risk of gastrointestinal hemorrhage. (Townsend, 2010)

Conversely, while Bowler et al found clearly established evidence on the positive impact of physical activity on health, their meta-analysis questioned whether location mattered. They did not find consistent evidence to support a positive impact on blood pressure and cortisol levels between natural and synthesized environments. Furthermore, while Bowler et al found quite a few studies on the impact of nature on a variety of health outcomes, they felt there was insufficient data to perform a powerful meta-analysis. Some of the topics they came across included the effect on immune function of walking in a forest. Other hormones apart from cortisol levels have been studied such as adrenaline, noradrenaline and salivary amylase. The outcomes from these studies showed mixed findings. Bowler et al reviewed a longer term study

² www.hc-sc.gc.ca/hi-vs/physactiv/index-eng.php

that compared a 10 week leisure program with centre-based activities to an instructor-led walking program through parks and open spaces, and also to an advice-only group. This study included follow up assessments at 10 weeks, six months and one year and measured a range of physical and mental health, and physical fitness outcomes. The results show that there was generally little difference in health/well-being benefits between the two activity groups, even when compared to the advice-only group (Bowler, 2010).

Specific to the pediatric population, Godbey completed a literature review of outdoor recreation, health and wellness to help guide policy-makers. He found that children who spent time outdoors were healthier and more physically active than their indoor peers. Godbey found that studies using direct observation of preschool children showed that being outdoors is the strongest correlate of the children's physical activity. His research further supports that children and adolescents with easy access to recreational facilities and programs are more active than those without. According to Godbey, 61 percent of American children do not have access to a playground. Although being outdoors is known to be conducive to physical activity, he found little research had been done on children's outdoor playtime as it relates directly to health outcomes.

McCurdy and colleagues reviewed evidence of the physical and mental health benefits associated with unstructured, outdoor activities in a natural environment in the pediatric population. They too found clear evidence in literature that an increase in sedentary indoor lifestyles has contributed to childhood diseases, including obesity, asthma, ADHD and vitamin D deficiency. There is a clear link between these childhood diseases and adult pulmonary, cardiovascular and mental health illnesses. McCurdy referenced a number of studies showing a positive association between availability of green space/park facilities and BMI in the pediatric

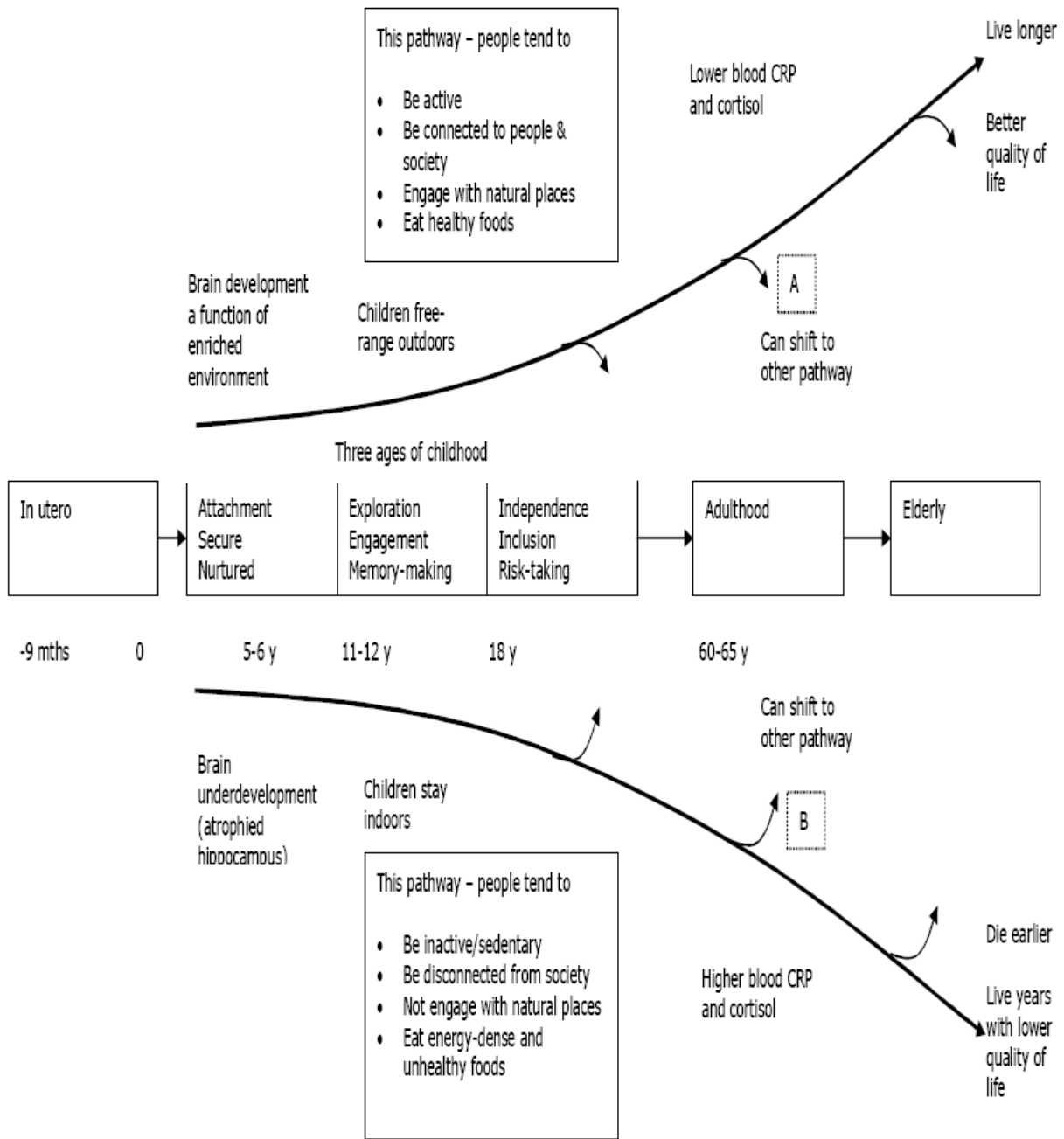
population. One study she reviewed showed children who lived within a kilometer of a park with a playground were almost five times more likely to be classified at a healthier weight than children without accessible playgrounds. She suggests this association indicates the children with access to playgrounds must be achieving the appropriate amount of activity to maintain a healthy BMI. (McCurdy, 2010)

Pretty et al took their literary review on nature and health from the US, Scandinavia, Japan and the UK and applied it to what they term “life pathways”. Their research indicated that children's contact with nature and consequent levels of physical activity affect not only their well-being but also their health in later life, which agrees with the conclusions drawn in the previously discussed papers. They propose two pathways within which all our lives are shaped (figure 1). At the top, people live longer with a better quality of life; at the bottom they die earlier and often live years with a lower quality of life. On the healthy pathway, people tend to be active, be connected to people and society, engage with natural places, and eat healthy foods. As a result, they tend to have higher self-esteem and better mood, be members of groups and volunteer more, keep learning, engage regularly with nature and be more resilient to stress. Many of the drivers pushing individuals towards the unhealthy lower pathway are very recent in human history: consumption of unhealthy foods, increasing inactivity, atomization of families and communities, and disengagement from nature. They concluded that green exercise at a young age leads to positive health outcomes, promotes ecological knowledge, fosters social bonds and influences behavioural choices which set individuals on their life pathways. (Pretty, 2009)

Finally, access to natural environments may reduce health inequalities by promoting physical activity and offering protection from the biological effects of poverty-related stress. McCurdy et al reviewed a study to determine if exposure to “green space” such as parks, forests,

rivers, creeks, and play fields was a determinant of good health, more than 40 million people from England were classified based on level of income and access to natural environments. Records for all causes of mortality, as well as circulatory disease, lung cancer, and intentional self-harm, were obtained from 2001 to 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 areas with the most nature had the lowest level all-cause mortality and mortality due to circulatory diseases related to income deprivation. He suggests that exposure to natural environments could play a vital role in reducing health inequalities.

Figure 1: Life Pathways



Natural Environments and Mental Health

Mental illness such as depression, anxiety disorders and schizophrenia are potentially debilitating conditions, and affect over 450 million people, families and careers globally. Mental ill health has adverse economic and social impacts for those affected and for those connected to them, both directly and indirectly. Mental health disorders constitute 10 per cent of the global burden of disease. (Townsend, 2010)

Townsend et al's literary review revealed evidence that contact with nature affects numerous facets of a person's physical, mental and social life such as reducing anger, frustration and aggression, increasing a sense of belonging and acceptance, improving socialization, mobility, mental stimulation, touch and physiological benefits, and fulfilling basic needs such as love, respect, usefulness, trust, self-worth and nurturing. They found further evidence that natural environments have been shown to increase feelings of social safety and to reduce crime and aggressive behaviours.

Bowler et al found literature that clearly showed positive benefits of exercising in a natural environment over a synthetic environment from an emotional point of view, specifically on lowering depression through organized green exercise programs, but wondered if this was from a combination of the positive physiological effects of exercise and the social participation in these group environments rather than the impact of nature.

Godbey concluded that stress reduction appears to be an important benefit reported by older visitors to local parks. Negative moods decrease after spending time in a park, and park users report lower levels of anxiety and sadness. The longer people stay at a park, the less stressed they report feeling. A national telephone survey of 1,300 households found that the benefits the American public most frequently associated with use of recreational services were

exercise and fitness; relaxation and peace (stress reduction) were the second most frequently mentioned. Godbey reviewed one study based on self-reported stress. It showed a statistically significant relationship between the use of urban green spaces and stress reduction, regardless of the respondent's age, sex, or socioeconomic status. The results suggest that the more often a person visits urban green spaces, the less often he or she reports stress-related illnesses.

Within the pediatric population, the impact of nature on Attention Deficit Hyperactivity Disorder (ADHD) is the most studied. The Centre for Disease Control estimates that 4.4 million youths, age 4-17, have been diagnosed with ADHD, and in 2003, 2.5 million were receiving medication for their disorder.³ Research has shown that spending any amount of time outdoors can reduce the symptoms of ADHD, even in children who have not responded to medication. (Godbey, 2009)

Natural outdoor activities had more of a positive impact on symptoms than those activities conducted in manufactured indoor and/or outdoor settings, implying the type of outdoor activity engaged in may impact certain diseases more than others. (McCurdy, 2010) However these studies were based on parental questionnaires and the reliability of parental assessment as a measure of ADHD symptoms is unclear.

Other Benefits

These papers discussed numerous other benefits of exposure to nature. Tree density is correlated to lower prevalence of childhood asthma; however the extent to which trees and vegetation play a role remains unknown. (McCurdy, 2010) The incidence of myopia or nearsightedness amongst 12 year olds decreased with higher levels of outdoor time, although not many studies have been conducted in this area. (McCurdy, 2010) Although studies on pain

³ <http://www.cdc.gov/ncbddd/adhd/data.html>

management in the adult population have been conducted, the restorative effects in the pediatric population have not yet been studied. (McCurdy, 2010)

Evolutionary history

Humans have evolved living close to the land as hunter gatherers, and only recently have we congregated into densely populated cities. Humans have a special affinity for nature, and literature over many centuries is full of gardens, pastoral landscapes and natural settings where people can take refuge, find shelter and comfort during moments of sadness and pain; as places where the body and mind can both heal. (Townsend, 2010)

It is commonly believed that children have a predilection for natural environments and that environments preferred by children are primarily comprised of natural elements. A study was conducted in Canada to evaluate the preferred place of children from low-income families living in poor neighbourhoods. The majority of children referred to nature during the description of their favourite places, and showed awareness and sensitivity to the natural elements present in the environments, such as specific trees and even a flowering plant. (Townsend, 2010) The outdoors is believed to be one of the most suitable and favourite places for young children to indulge in free play and gross motor activity, due to the presence of trees and flowers.

Discussion/Conclusions

Research has confirmed a link between physical activity that takes place outdoors and positive health outcomes—and also an association between an indoor, sedentary lifestyle and negative health consequences. There is also evidence that both being outdoors and viewing natural scenes can reduce stress. The links are sufficiently strong that researchers and

practitioners in health- related fields are now beginning to identify parks and recreation as a health service. Outdoor recreation's contribution to health can be considered in the context of wellness. The World Health Organization (2003) defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”.⁴ This definition moves from a strictly medical model of health toward the concept of well-being. The Alberta Centre for Well Being (1989) finds that “the concept of well-being or optimal health involves a delicate balance among physical, emotional, spiritual, intellectual and social health” and then lists a wide range of dimensions, from fitness, nutrition, and stress management to meditation, education, and relationships.⁵ Outdoor recreation touches on all those aspects of health and can enhance not only physical health but also emotional well-being.

The literature on outdoor recreation as it relates to human health is vast and growing. As childhood obesity levels and obesity-related disease rates continue to climb, and the cost of health care escalates, it is important to analyse the current data available on the impact of nature and health, and target future research. Four of the reports reviewed in this paper were literature reviews of this available data, one was a meta-analysis. Many of them were policy driven, with the goal of advising policy makers and health care providers to make evidence-based recommendations. They made recommendations and identified areas that require further study.

Townsend et al provide a review of existing Australian and international literature on the links between mental health and well-being and contact with nature, especially through green spaces. They were commissioned by “beyondblue”, the national depression initiative in Australia.⁶ The evidence used in this review was drawn from a range of sources including relevant electronic databases, peer-reviewed journals and grey literature. Their focus was

⁴ <http://www.who.int/about/definition/en/print.html>

⁵ <http://www.centre4activeliving.ca/about/facts-who-we-are.html>

⁶ <http://www.beyondblue.org.au/>

narrowed to parks and green open spaces and their impact on mental health, specifically depression and anxiety in the adult populations, with minimal focus on the pediatric population. They drew upon mainly recent literature, but also drew upon older literature, the details of which they did not elaborate on. A literature review is an appropriate study design for the scope of their question. This paper does not elaborate on their inclusion or exclusion criteria. The overall feeling of the paper is biased towards the positive impact of nature on health and wellbeing, with very little argument or evidence provided to argue against their theory. Furthermore this review does not discuss possible weaknesses as to the validity of the papers it reviewed.

McCurdy et al reviewed the current evidence of the health benefits from outdoor physical activity in natural environments and proposes that health care providers do more to promote children's outdoor physical activity in natural settings. The paper was very well laid out and organized. When specific evidence was provided from their reviewed literature, potential sources of bias and weaknesses of the study design were detailed, adding validity to their argument. The authors further identify areas where more research needs to be conducted.

Pretty et al are employed by the Interdisciplinary Centre for Environment and Society at the University of Essex in Britain. They link the concept in current literature that physical activity and exposure to nature positively influence health and well being, and the fact that social and environmental conditions of childhood predict and track adult health status, and they develop a theory on two different "life pathways" detailed above in figure 1. They then suggest that attention should be paid to developing the use of green exercise as a therapeutic intervention (green care), that planners and architects should improve access to green space (green design), and that children should be encouraged to spend more time engaging with nature and given opportunities to learn in outdoor settings (green education). They predict these early

interventions would put more individuals on the "healthy" life pathway and save governments millions of dollars. In this paper the inclusion/exclusion criteria for the papers reviewed was not discussed, nor was the validity of the papers. Their focus was on the life pathway and developing a link between childhood intervention and positive health outcomes in adulthood for their proposed theory. That being said they had an overwhelming number of international research papers and evidence to support their theory.

Godbey completed a discussion paper prepared for the Outdoor Resources Review Group Resources for the Future Background Study. His paper summarizes the salient issues within literature on outdoor recreation and how they relate to human health, to help American policy makers design recreation and park services and initiatives for the 21st century. Particular attention is given to children's health problems that can be mitigated through outdoor play, sports, and nature study. Being a discussion paper, he does not detail the pros and cons of the papers he included as evidence. He too presents an overwhelming amount of evidence in support of nature's positive impact on health, the validity of which is not discussed. Throughout the paper he identifies gaps in research, and proposes research questions to be pursued.

Bowler et al felt the evidence base for specific and direct health or well-being benefits of activity within natural compared to more synthetic environments has not been systematically assessed, thus they conducted a systematic review to collate and synthesize the findings of studies that compare measurements of health or well-being in natural and synthetic environments. Effect sizes of the differences between environments were calculated and meta-analysis used to synthesize data from studies measuring similar outcomes. Their systemic review was broad, their inclusion criteria was specific and well defined. Twenty-five studies met the review inclusion criteria. Most of these studies were crossover or controlled trials that

investigated the effects of short-term exposure to each environment during a walk or run. This included “natural” environments, such as public parks and green university campuses, and synthetic environments, such as indoor and outdoor built environments. The most common outcome measures were scores of different self-reported emotions. Sufficient detail was provided on the primary studies and their quality was assessed.

Conclusion

Further research is needed to determine what specific benefits are realized from what specific activity, exactly who benefits, and in which specific environment(s). From this research Public Health can target resources to interventions that have specific outcomes for specific target groups. Further research is necessary to investigate whether comparable effects are observed in different populations, environments and social contexts, and the longer-term significance of repeated exposure on health.

That being said, physical activity is shown to improve children’s health, and a growing body of evidence suggests that exposure to natural environments can improve attention and decrease stress in children. Advising outdoor play in nature is a practical method for pediatric health care providers to address chronic conditions such as childhood obesity, as well as mental health, and one that is cost-effective and sustainable. These early childhood interventions and exposures translate into healthier adults, and healthcare dollars saved. Thus, counselling public and private decision-makers to expose children to increased outdoor time, teaches them how to protect their wellbeing and their environment resulting in long term health and wellness benefits.

Works Cited

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