

# Physical Activity in Natural Settings: An Opportunity for Lifestyle Medicine

**Abstract:** *Physical activity is a well-known behavior for promoting health and preventing a variety of chronic diseases. Despite widespread knowledge of the benefits of physical activity, most Americans do not engage in sufficient physical activity. Over the past decade, there has been increasing recognition of the health benefits of spending time in nature, mediated in part through physical activity. This has led to new partnerships across health, parks and recreation, public lands, and environmental organizations to increase time spent, and physical activity, in natural settings. This review assesses the current evidence around physical activity in natural settings (PANS), strategies for promoting PANS including health professional engagement, and current gaps in the research literature.*



**Keywords:** nature exposure; greenspace; physical activity; prescriptions; lifestyle medicine; behavior change

## Introduction

Regular physical activity provides a wide range of health benefits

across the lifespan.<sup>1-7</sup> These include primary and secondary prevention of chronic conditions including cardiovascular disease, diabetes, some cancers, and osteoporosis. Immune function is improved,

and that children and adolescents get 60 minutes or more of moderate to vigorous physical activity daily.<sup>12</sup> There may be a dose-response relationship in health benefits up to 300 minutes a week

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pain control enhanced, the risk of falls reduced, life expectancy extended. Physical activity appears to have a positive effect on several aspects of mental health including mood, mild cognitive impairment, anxiety, dementia, and depression.<sup>8-11</sup> The Physical Activity Guidelines for Americans recommends that adults get 150-300 minutes a week of moderate physical activity or 75-150 minutes a week of vigorous physical activity a week for health benefits,

of moderate to vigorous physical activity (MVPA).<sup>2</sup> However, an on-line survey 2 years after the 2018 release of guidelines showed that less than one-quarter of American adults were aware of them.<sup>13</sup> Indeed, despite almost 30 years of physical activity guidelines, recent CDC data showed that more than one-quarter of Americans got no leisure time physical activity in the past month and only 24% meet both the aerobic and muscle strengthening

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guidelines (<https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html>). Given the limited progress in increasing physical activity, new approaches may be needed to motivate sedentary people to become active.

There is growing evidence and recognition of the health benefits of spending time in nature. Like physical activity, nature contact offers a wide range of benefits, ranging from improved cognitive function and mood to pain control, improved immune function, improved birth outcomes, and reduced mortality. These benefits have been extensively reviewed.<sup>14-19</sup> A predisposition to benefit from nature contact may have evolutionary roots, as proposed by biologist E.O. Wilson's biophilia hypothesis.<sup>20</sup> Multiple mechanisms likely operate in delivering the benefits, including stress reduction,<sup>21</sup> attention restoration,<sup>22</sup> social connections,<sup>23</sup> and enhanced immune function.<sup>24</sup> One likely pathway is physical activity: natural settings are appealing, even inspiring, venues for walking, jogging, cycling, and other forms of utilitarian and recreational active living.<sup>25</sup>

### Benefits Other than Physical Activity

A discussion of the benefits of PANS would be incomplete without mentioning collateral benefits that accompany the benefits of physical activity. Natural settings such as parks are associated with improved mental health,<sup>26</sup> social connections,<sup>23,27</sup> sense of community,<sup>28</sup> climate resilience,<sup>29</sup> and other benefits, apart from those of physical activity. A full reckoning of public health benefits needs to account for this broad portfolio.

Growing recognition of the health benefits of nature contact may present lifestyle medicine with opportunities to promote physical

activity.<sup>30</sup> In this narrative review, we examine the following questions at the intersection of 2 health-promoting behaviors—physical activity and nature contact:

1. Does Physical Activity in Natural Settings (PANS) deliver health and well-being benefits above and beyond the benefits of physical activity in indoor or other nature-poor settings?
2. What are the correlates of PANS at the individual and community level?
3. What should be taken into account when promoting PANS in priority populations?
4. What can health professionals do to promote PANS?

### Does Physical Activity in Natural Settings (PANS) Deliver Health and Well-Being Benefits Above and Beyond the Benefits of Physical Activity in Indoor or Other Nature-poor Settings?

Physical activity can occur in a variety of contexts, with or without nature contact: people can walk on a forest trail or in a mall, swim in a lake or in a pool, cycle on a Peloton or through a park. Physical activity research, with its roots in exercise science, has typically quantified activity in terms of time (minutes) and intensity (METs, or metabolic equivalents of task), without regard for environmental context.<sup>31</sup> The metabolic expenditure of over 800 different activities has been quantified.<sup>32</sup> Conversely, experimental research on the benefits of nature exposure has typically controlled for physical activity levels, in order to isolate and test the effect of context (the natural environment).<sup>33</sup>

The evidence base on the interaction of these 2 variables—the *amount* of physical activity, and the *natural setting* of the physical activity—is far more limited than for either

individually. The concept of “green exercise” arose in the early 2000s, based on the hypothesis that PANS offers benefits above and beyond those of isocaloric physical activity in non-natural settings.<sup>34</sup> Research on green exercise has accumulated in the 2 decades since. In a typical experimental study design, participants exercise in both natural and non-natural settings with equivalent caloric expenditure, and 2 kinds of outcomes are measured before and after each round of exercise: self-reported subjective responses, and objective tests of performance or physiology.

For example, Bailey et al.<sup>35</sup> compared the cognitive effects of indoor track and nature trail walks in ten students, using 2 cognitive tests (the Stroop Test and the Backward Digit Span Task) and mobile electroencephalography before and after each walk. Both types of walks yielded improvements, but the nature trail walks led to greater improvement on the Stroop test, significantly higher levels of meditative state on EEG, and greater persistence of these improvements, relative to the indoor track walks. Similarly, Rogerson et al.<sup>36</sup> compared the effects of 15 minutes of ergometer cycling in indoor and natural outdoor settings, in a sample of 24 volunteers. They measured directed attention (with the digit span backwards test), mood (with the Profile of Mood States), social interaction (by quantifying conversation with other cyclists while cycling), and self-reported enjoyment of the rides. Directed attention scores worsened during the indoor rides, but improved during natural outdoor rides. Mood remained unchanged in both settings, nor did the indoor and outdoor rides differ with respect to self-reported enjoyment. The natural outdoor rides were associated with significantly greater social interaction than the indoor rides.

Boere et al.<sup>37</sup> studied 30 volunteers who took walks in both indoor and outdoor settings. Before and after each walk, subjects completed a visual oddball task, in which repetitive stimuli are irregularly interrupted by a different stimulus, during mobile electroencephalography. The investigators observed improved task performance and an increase in the P300 amplitude, which is associated with attention and working memory, following the outside walk but not the inside walk.

Several systematic reviews of experiments and laboratory studies such as these have been published.<sup>38-42</sup> They converge on several conclusions: that the published studies are highly heterogeneous in study design and outcomes measured, are of low overall quality, and feature considerable risk of bias. There is some suggestion that green exercise may be associated with improved self-reported affect (such as feelings of revitalization and positive engagement, and decreased tension and anger), with greater enjoyment of the activity, and perhaps with lower perceived exertion, compared to indoor exercise, but results for emotion and biological markers have not shown a consistent advantage for green exercise. The available experimental research focuses on short-term outcomes; there is essentially no evidence available comparing long-term (1 year or longer) outcomes of PANS and indoor exercise. Thus, while PANS may be superior to indoor physical activity in at least some respects, the jury is still out.

### What are the Correlates of PANS at the Individual and Community Level?

Irrespective of whether PANS is more beneficial than isocaloric indoor physical activity, natural settings may still function as an

effective venue for promoting physical activity. Many people like being active in outdoor settings. In 1 study, people who visited local greenspaces at least weekly were 4 times more likely to achieve recommended levels of physical activity than those who never visited.<sup>43</sup> A review of 49 greenspace interventions for mental health examined context, mechanism and outcomes to assess what worked, for whom, and in what circumstance.<sup>44</sup> Optimizing these benefits depends on: a) getting people into natural settings; b) increasing their level of physical activity once they are there; and c) maximizing the benefits that flow from that activity. We address each of these steps below.

#### What factors are related to increased visits in natural settings?

People contact nature in a range of settings, including public places such as parks, trails, green schoolyards, and community gardens, as well as on private property. Some urban greenspace, such as utility rights-of-way, are “informal” and omitted from official designations.<sup>45</sup> Parks play an especially important role as most are free and open to all, and widely distributed; accordingly, parks are one of the leading settings for nature contact (even if they are not always fully utilized<sup>46</sup>). Trails and community gardens also provide venues for physical activity. What is associated with visits to such places? A considerable body of evidence helps answer this question. Our discussion follows the social ecological model from the community to the organizational to the individual levels.<sup>47</sup>

At the community level, *access* is 1 factor related to park visits. If parks are located near where people live, and if the parks are easily reached—without barriers such as busy roadway, fences, or walls, and with convenient public transportation for

those who need it—then people visit the parks more frequently.<sup>48-52</sup> The same is true of trails.<sup>53,54</sup> Access to parks and trails varies significantly by geography. According to the CDC’s National Environmental Public Health Tracking network (<https://ephrtracking.cdc.gov/DataExplorer>), 97.3% of people in Illinois live within ½ mile of a park compared to only 29.0% of people in Mississippi.<sup>26</sup> Ironically, people in rural areas may have less nearby access to natural areas than people in cities, as much rural land is privately held.<sup>55</sup>

Another dimension of access is cost; people who cannot afford transportation, entry fees, and other costs of a park visit are less likely to visit—a constraint that falls disproportionately on minority communities and on those in poverty.<sup>56</sup>

The *neighborhood context* also affects park and trail visits. A study in Pittsburgh compared 2 low-income neighborhoods, one of which underwent renovations that improved walkability, reduced incivilities, and improved aesthetics. Increased walkability was associated with a 2.75-fold increase in park visits, while more incivilities and poor aesthetics near parks were associated with a nearly 40% reduction in park visits.<sup>57</sup>

*Physical features* of parks and trails also have an impact on park visits. Facilities such as community centers, playgrounds, fitness equipment, and sports fields; amenities such as benches, shade structures, restrooms, and lighting; paved surfaces and clear signage on trails; natural features such as tree canopy, lawns, and water bodies; overall attractiveness; and good maintenance are all associated with increased visits.<sup>49,53,54,58-71</sup>

Conversely, some features discourage visitation. For example, in a study of trails, tunnels, excessive trailside vegetation and drainage infrastructure, were negatively

associated with trail use.<sup>72</sup> In another study, children, when offered many park features, reported being most eager to visit parks with large adventure playgrounds, giant slides, and interactive areas.<sup>73</sup> And in a survey of adolescents in Melbourne, the features identified as most likely to attract them to parks were playground slides, swings, walking and cycling paths, BMX tracks and skate bowls, and the absence of trash and graffiti.<sup>74</sup> The relative importance of various of these physical features in influencing park and trail visits varies across demographic groups and studies.

Community gardens represent a particular natural setting for physical activity. In addition to the social capital, food security, and environmental benefits they deliver, they are settings for PANS. Gardening can range from light to vigorous physical activity, depending on specific tasks performed (in the range of 2.0 METs for planting and potting, to the range of 5.5 METs for shoveling dirt or mud). A thematic review of 51 studies found that community gardens had a positive impact on reducing body weight and hypertension and increasing physical activity in vulnerable populations.<sup>75</sup> Three systematic reviews reached differing conclusions with regard to physical activity. The first included 53 studies, with low overall quality, and found mixed results,<sup>76</sup> the second included 19 studies and found mixed results,<sup>77</sup> while the third was limited to 8 higher quality studies, and found an association between community gardening and physical activity.<sup>78</sup> A rigorous randomized trial in Denver, published after those reviews, found an association between community gardening and physical activity.<sup>79</sup> Factors associated with participation in community gardening include sufficient plots to accommodate those who wish to garden, proximity to home, and a sense of welcoming

and belonging (especially for immigrant and refugee populations),<sup>80</sup> while barriers include legal and policy barriers to the allocation of public land for gardens,<sup>81</sup> as well as potential participants' time, financial resources, and gardening know-how.<sup>82,83</sup>

*Programming* is a strong correlate of park visits. The parks offer classes, festivals, community services, and other organized activities, people are more likely to visit them. In fact, programming may be an even more important determinant of visits than such factors as perceived threats.<sup>84,85</sup>

*Public engagement* in park and trail design, operation, and oversight is yet another predictor of visits. Communities that feel a sense of ownership, and are actively involved in stewardship of the park or trail, are more likely to use it.<sup>86</sup>

It is not only access, physical features, and programming that are related to park and trail visits; individual and social level factors also matter. People need to feel welcome in a park, to feel a sense of belonging. When this is absent, park visitation declines<sup>87,88</sup>—an especially salient factor for members of marginalized communities such as racial and ethnic minorities and immigrants.<sup>89-94</sup> Even if a park is nearby, members of minority communities may be inhibited from visiting due to the racial or ethnic discrimination, lack of knowledge of opportunities, lack of time, and inability to communicate with park employees due to language barriers.<sup>95-98</sup>

*Perceptions* also matter.<sup>99</sup> When people perceive that a park or trail is safe, nearby, accessible, and of high quality, and that other people (including their friends) use it, they are more likely to use it as well.<sup>99,100</sup> Active marketing of parks has been shown to increase park use, perhaps through positively influencing perception.<sup>101</sup> Perceived safety emerges in most studies as a key

predictor of park and trail visits, especially for women, seniors, and parents (with respect to their children's visits).<sup>102,103</sup> In a survey of 3815 adults in 4 U.S. metropolitan areas, people who perceived parks in their communities as safe or very safe had 4.6 times the odds of visiting the parks as those who perceived the parks as unsafe.<sup>104</sup> Interestingly, some users perceive paved trails to be safer than natural-surface trails.<sup>105</sup>

Another correlate of visits to parks and greenspace is one's *attitudes and beliefs*. Bloemsma et al.,<sup>106</sup> in a longitudinal study of over 3,000 Dutch adolescents, found that people who stated that greenspace was important to them visited parks and greenspaces five to seven times more frequently than those without that belief. A survey of 1,396 people in Singapore, including frequent and infrequent park users and non-users, revealed that "nature orientation," as reflected by endorsing statements such as "I always think about how my actions affect the environment" and "My relationship to nature is an important part of who I am," was a stronger determinant of park visitation than any other factor tested (including social norms, accessibility of the parks, and leisure time).<sup>107</sup> And a survey of 516 parents of school-age children in Japan found a strong association between parents' belief that nature play was beneficial and the frequency of their children's greenspace visits.<sup>108</sup>

It seems intuitive that more visits to parks and trails might be associated with more physical activity—an intuition supported by empirical data.<sup>109-111</sup> But are there ways to strengthen this association? Once people are in natural settings, what factors serve to promote physical activity?

### How to Promote Physical Activity in Natural Settings?

Simply having more parkland available is associated with increased park-specific physical activity among young people.<sup>112</sup> But



as with visits, physical activity in parks and on trails depends in part on *facilities and amenities*.

Correlates of physical activity in parks include sports facilities such as basketball courts and swimming pools; children's play equipment; paths for walking, jogging, and cycling; natural features such as vegetation, water, and topographical variety; and playing fields.<sup>113-115</sup> A systematic review of interventions to increase park participation and physical activity found evidence supporting playgrounds, safe access to parks, and park renovations and renewal, while noting a risk of bias and issues with study quality.<sup>116</sup> On the other hand, elaborate facilities and extensive acreage are not always required; in urban settings, even small pocket parks can promote physical activity, as people walk to them from their homes.<sup>117</sup>

As climate change intensifies and extreme heat becomes more prevalent, shade is an important predictor of physical activity, not only in parks<sup>118</sup> but also in schoolyards<sup>119,120</sup> and in neighborhoods.<sup>121</sup> Trees provide both shade and nature contact, although built shade structures in parks and parklike settings can also reduce temperatures and promote physical activity.<sup>122</sup>

*Neighborhood context* also matters for physical activity in natural settings. Auchincloss et al.<sup>123</sup> studied a natural experiment—the 2013 construction of a 1.5-mile urban greenway along arterial streets in a poor, high-crime neighborhood in Philadelphia—using systematic observation before and after the construction, both near the greenway and in a comparable comparison neighborhood. There were small increases in MVPA after the greenway was built, but no more than occurred in the comparison neighborhood. The authors concluded that comprehensive

improvements to the built and social environment might have been needed to promote physical activity on the greenway.

*Organized activities* in parks and other urban natural settings, such as yoga classes, volunteer cleanups, organized walks, and sports leagues, are associated with increased physical activity in those settings.<sup>124-129</sup> Park programming for physical activity such as Italy's "Moving Parks" may be helpful in increasing PANS.<sup>130</sup> Indeed, the Community Preventive Services Task Force found insufficient evidence that park, trail, and greenway infrastructure alone promote physical activity, but that when combined with additional interventions such as structured programs, they were effective.<sup>131</sup>

Importantly, the use of parks and greenspaces for physical activity varies across demographic groups. Males are more likely to utilize these spaces for physical activity than are females.<sup>132</sup> In a study in Los Angeles parks, with Whites as a baseline, Blacks and English-speaking Latinos were less likely to report park-based physical activity, Spanish-speaking Latinos were equally likely, and Asian/Pacific Islanders more likely (although not with statistical significance).<sup>133</sup>

Two kinds of natural settings deserve special mention as venues for physical activity: green schoolyard and community gardens. *Green schoolyards* are schoolyards that have been improved with trees, gardens, and other vegetation; outdoor learning areas; naturalized play equipment; pervious surfaces; and other features. This design approach is grounded in extensive evidence of the benefits of nature contact for children's health, behavior, and academic achievement.<sup>15,17,134-137</sup> A systematic review in 2021 summarized numerous observational studies and 6 experimental studies (4 in Europe,

1 in Canada and 1 in the United States). While the results were somewhat mixed, green schoolyards appeared to increase physical activity while reducing sedentary time—a finding corroborated by subsequent studies.<sup>138,139</sup> (In contrast, 1 study found more MVPA on asphalt surfaces than on grassy areas.<sup>140</sup>) Features of green schoolyards that promote physical activity include separately demarcated play areas (as opposed to a single continuous space), shade trees, and equipment for climbing and balancing.<sup>141</sup> Of note, green schoolyards can double as community parks when school is not in session, if schools execute joint use agreements with city park departments.

### The Importance of Nature Connectedness for the Mental Health Benefits of PANS

Once a person goes to a park or greenspace, and once that person engages in physical activity while there, how can the benefits of that physical activity be optimized? Imagine two joggers in a natural setting—one who listens to a podcast through earphones, the other who mindfully "blisses out" on the vegetation and birdsongs. Or imagine two hikers in a natural area, one who feels unfamiliar and uneasy in the surroundings, the other who feels deeply at home and comfortable. Might the same intensity and duration of physical activity, in the same natural setting, be more or less beneficial depending upon differing "receiver" characteristics?

Here the concept of *nature connectedness* may be relevant. Nature connectedness (also referred to as nature relatedness) refers to the extent to which a person identifies with and feels connected to the natural world.<sup>142</sup> It is a cognitive, affective, and behavioral construct,<sup>143</sup> operationalized through measures such as the

Inclusion of Nature in Self Scale (Schultz, 2001), the Connectedness to Nature Scale<sup>144</sup> (and its brief version<sup>145</sup>), the Nature Relatedness Scale<sup>146</sup> (and its brief version<sup>147</sup>) and the Attitude Toward Spending Time in Nature Scale.<sup>148</sup> High levels of nature connectedness have been associated with more physical activity and with more time outdoors in both children and adults<sup>149-151</sup> (although not in all studies<sup>152</sup>), with less anxiety,<sup>153</sup> and with greater life satisfaction and happiness<sup>154-157</sup>—perhaps related to, or mediated through, mindfulness while in nature.<sup>158,159</sup> Do people who are more nature-connected benefit more from PANS?

Jenkins et al,<sup>160</sup> in a survey of 262 physically active adults in New Zealand, found a strong association between PANS and eudaimonic well-being (the sense of meaning, purpose, flourishing, self-discovery, and reaching one's potential)—and found that the association was mediated by nature relatedness (as measured by the Nature Relatedness scale). Other studies of people engaging in PANS, in Portugal,<sup>161</sup> Italy,<sup>162</sup> and the U.K.,<sup>163</sup> also found that greater nature connectedness predicted better outcomes (well-being, psychological restoration, and reduced anxiety, respectively). While the evidence base is sparse, available data suggest that nature connectedness may enhance the benefits of PANS—perhaps suggesting, in turn, that promoting nature connectedness through childhood experiences, education, biophilic environments, and/or other approaches may represent a public health strategy for potentiating the benefits of PANS.<sup>164,165</sup>

### What Should be Taken Into Account When Promoting PANS in Priority Populations?

Promoting PANS needs to reckon with barriers faces by particular populations. Black, Indigenous, and

other People of Color (BIPOC) and immigrant and refugee populations confront historical and current discrimination that can impede their access to natural spaces. People at both ends of the lifespan—children and older adults—bring particular needs, as do people with disabilities.

*BIPOC and immigrant/refugee populations, and those who are poor*, confront longstanding inequities in available resources, compounded by ongoing discrimination. Parks, playgrounds, and other greenspaces are farther from home, smaller in area, and of poorer quality, than in White and/or affluent neighborhoods.<sup>166-168</sup> Street tree canopy is similarly maldistributed.<sup>169</sup> However, nature contact may deliver disproportionate health benefits to these populations—a phenomenon that has been called the “equigenic effect,” as it functions to reduce health disparities.<sup>170,171</sup> Accordingly, it is especially important to address inequities in nature access, if PANS is to be promoted in marginalized populations. However, improving nature-poor neighborhoods with parks and greenspace may have the unintended consequence of driving up housing prices and property taxes, a phenomenon known as green gentrification; this can result in displacing members established communities.<sup>172</sup> Strategies for equitably improving nature access while avoiding displacement include documenting disparities in greenspace access through mapping, prioritizing the provision of greenspace to areas of relative deprivation; actively engaging communities in the design and stewardship of parks; maintenance to keep public greenspaces safe and inviting; inclusive facility design and programming; connectivity of greenspaces to where people live, through transit and pedestrian/bicycle infrastructure, and anti-displacement policies such as

affordable housing provision to minimize disruption caused by green gentrification.<sup>173,174</sup>

*Children* can engage in PANS both in designated playgrounds in schoolyards and parks, and in unstructured natural areas. Indeed, a systematic review of the benefits of nature contact for children identified physical activity as the pathway most strongly supported by evidence.<sup>17</sup> Factors that help get children outdoors and physically active include parents who prioritize nature contact,<sup>108</sup> ample nearby parks and greenspace,<sup>112,175,176</sup> safe routes to parks and greenspaces,<sup>175</sup> perceived safety within the parks and greenspaces,<sup>177</sup> and programmatic initiatives to encourage outdoor activity, including initiatives that engage parents as well as children.<sup>178,179</sup> The evidence on what features of outdoor playgrounds best promote physical activity in children is mixed. A systematic review of studies on playground designs found that playground markings, game equipment, or a combination of the two, were not associated with children's physical activity levels, but that physical structures such as climbing equipment was.<sup>180</sup> A later meta-analysis of studies of playground interventions and physical activity found that interventions such as the use of multicolored markings and a sporting playground zonal design did increase physical activity, but only to a small degree.<sup>181</sup> Evidence suggests that schoolyard features including ample grassy fields, less crowding, shade from trees, and distinct play zones are associated with more physical activity.<sup>141</sup>

*Older adults* face several challenges when spending time in nature, including uneven and rough walkways, risk of falls, cognitive decline, dehydration and safety concerns. A systematic review of older adults' preferences for parks and open space found that needs

included more seating options, age-friendly programming, clean rest rooms and easily navigable paths.<sup>182</sup> Although parks are safer and more easily accessible than more undeveloped natural areas, studies in the United States have found that very few older adults use parks, especially when compared to cities in East Asia.<sup>183</sup> A “walk-along” interview study of older adults in Melbourne parks found that top priorities determining visits included a well-maintained, peaceful and attractive environment with established trees, gardens and birdlife; ample seating; pleasant paths; toilets; cafés; water features; shade/shelter; facilities for grandchildren; and the presence of other people. Features most valued for physical activity included walking paths, organized activities, and fitness equipment.<sup>184,185</sup> A key motivator of park visits for older adults is social connections,<sup>186-188</sup> so amenities that facilitate social contact, such as shaded benches, as well as programming such as gardening classes, may encourage park visits among older adults.

Indoor nature may represent an opportunity to promote physical activity among older adults in institutional settings, even if only light activity. However, a systematic review of indoor nature interventions found that while indoor gardening and horticulture programs were effective in promoting cognition, psychological well-being, social outcomes, and life satisfaction, physical activity did not emerge as a benefit.<sup>189</sup>

*People with disabilities*, including mobility limitations, visual disabilities, and others, confront physical barriers to visiting parks and greenspaces, such as steps, slopes, inaccessible transport, and inaccessible bathrooms.<sup>190</sup> However, social and institutional barriers such as unwelcoming social activities, cultural events, place branding and stigma may be as

important.<sup>191,192</sup> These barriers impede visits.<sup>193</sup> Solutions include careful design of facilities to permit use by people with disabilities<sup>194,195</sup>—but also programming that actively engages people with disabilities, building on strengths and contributions they may make.<sup>196</sup>

### What can Health Professionals do to Promote PANS?

An immediate option for health professionals is to integrate PANS promotion into clinical practice. An emerging therapeutic approach is to “prescribe” nature contact to patients, known as “NatureRx” or “ParkRx.” In these initiatives, health professionals recommend or refer patients to spend more time in nature. Nature prescription programs have varied greatly with respect to the health professional role (prescriber or recommender), the ways in which prescriptions are provided (written or verbal), the content of the prescriptions (specific parks, activities, and “doses” vs general recommendations), the integration with other aspects of health care such as medical records, and follow-up. Reviews have noted that the available studies are small, heterogeneous in design, and methodologically limited, but have suggested that nature prescriptions may have some efficacy.<sup>197-199</sup> It may be difficult for the individual clinician to implement park prescriptions; system-wide programs facilitated by executive leadership may be needed. Further research is needed to determine what forms of nature prescriptions are effective.

Health professionals can also promote PANS by engaging in this behavior themselves. Such modeling has been shown to be effective in promoting healthy behaviors.<sup>200,201</sup> It has the added benefit of promoting the health and well-being of health professionals themselves.

Third, health professionals can engage in community efforts to promote outdoor spaces. These range from “Walk With a Doc” programs to serving on the boards of local park conservancies or outdoor recreational groups. Such efforts can also be undertaken at the institutional level; health institutions can partner with community groups to promote the creation and use of parks and greenspaces. The Perelman School of Medicine at the University of Pennsylvania has worked to promote tree equity in Philadelphia,<sup>202</sup> and the M.D. Anderson Cancer Center in Houston has supported that city’s Be Well Communities initiative, in which promoting PANS is a central element (<https://www.mdanderson.org/research/research-areas/prevention-personalized-risk-assessment/be-well-communities.html>).

Fourth, health professionals can work to direct health funds toward the creation and maintenance of parks and greenspaces. This may occur in any of several ways: inclusion of park equity in Community Health Needs Assessments, followed by community investments to rectify documented deficits or inequities; directing Medicaid funds to parks and greenspace as a social determinant of health, pursuant to Medicaid waivers; and directing funds from health care conversion foundations (also known as health legacy foundations) to parks and greenspaces.<sup>203</sup>

### Conclusion

Both physical activity and spending time in nature provide a myriad of health benefits. While some evidence exists around short-term benefits additive benefits around PANS, longer term studies are needed. Several factors affect how often people spend time in PANS including access, physical features,

neighborhood context and programming. Similar factors affect the extent to which people are physically active once in natural settings, and still other factors may affect the level of benefit they experience once physically active. Specific barriers in BIPOC communities and among children, older adults, and people with disabilities may inhibit time spent in PANS. Health professionals can help increase their patients' time spent in nature through prescription programs, modeling, and other programmatic activities. Promoting PANS is a potentially powerful way to promote 2 important health behaviors simultaneously.

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