The Impact of Urban Green Space Accessibility on Quality of Life & Well-being: A Review of Recommendations for Size, Exposure Time, and Access to UGS

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Executive Summary

Urbanization and lifestyle changes have limited the opportunities for human contact with green space in urban settings. Meanwhile, climate change presents a threat to the natural environment and in turn urban community health. Urban green spaces are one way to preserve environmental and individual health in urban communities. They include gardens, parks, and other areas with grass, trees, or shrubs [35]. Urban green space is associated with better cardiovascular health, increased moderate-to-vigorous activity, lower body mass index (BMI), and a decreased prevalence of obesity [21, 3, 14, and 29]. These benefits depend on the type of green space, scale, accessibility, frequency of use, vegetation cover, and the age, gender, and socioeconomic status of the community. Studies show that green spaces are associated with self-reported lower prevalence and incidence rate of psychological distress including anxiety and depression, higher quality of life, and better overall health [1, 5, 8, 13, 25, 30, 34]. Urban green spaces provide a place for communities to gather for recreational activities, social events, physical activity, and leisure leading to an increase in social interactions [27]. Numerous studies suggest that social well-being is positively associated with the quality and amount of urban green spaces [15]. The 3-30-300 rule provides a guide for planners that considers the health benefits of viewing, living near, and accessing green space. It states that every individual should have a line of sight to at least 3 trees outside their home or workplace, every neighborhood should have 30% canopy coverage, and every individual should be within 300m of a large green space (~1 hectare). Moreover, an individual should spend a minimum of 2 hours per week in nature. Most East Coast cities, including Baltimore, contain adequate amounts of green space, but the distribution and quality of the green space are where the challenges lie in future planning. Urban green space accessibility considers both the existence and distance of these spaces, as well as the physical and psychological barriers associated with them. For an urban green space to be truly accessible, it should be located at least a 5-minute walk from a person's home. The elimination of physical obstacles such as fences and entrance fees as well as psychological barriers, including feelings of unease due to undesirable location or company, is essential. There should be sufficient, well-functioning equipment as well as adequate lighting and trash management to not only increase the appeal of urban green spaces, but also to enhance safety. Urban residents should be able to freely access and feel welcome and safe in urban green spaces. Due to the uneven distribution, not all urban residents can access urban green spaces. This is a major environmental justice concern because it disproportionately affects marginalized communities and their health. Public policy should aim to include requirements to increase and maintain canopy coverage in densely populated neighborhoods, enhance accessibility while preventing eco-gentrification of neglected neighborhoods, and incentivize citizens to grow urban green spaces like green roofs. Everyone has the right to a healthful environment in which their needs are met equitably, and urban green spaces are a vital tool in achieving this goal.

Introduction

The World Health Organization (WHO) defines "Urban Green Space," also known as UGS, as urban space covered by vegetation of any kind [31]. This includes smaller green spaces such as street trees, larger green spaces such as parks, and private green spaces such as green roofs, atriums, and yards in private residences and businesses [31]. These are all important and contribute to a range of ecological and community health benefits, and it is important to consider each of them when planning urban areas. Lack of access to adequate UGS is an environmental justice issue. In Baltimore City, a higher proportion of Black residents have access to parks within walking distance than White residents, yet White residents have access to more acreage within walking distance than Black residents [26]. As this paper will outline, increased park acreage leads to greater health benefits.

Large UGS, like parks, also help mitigate the effects of climate change in cities by moderating heat, reducing air pollution, absorbing precipitation, filtering water pollution, and reducing floods [26]. The incorporation and maintenance of UGS have become increasingly important in protecting the well-being of urban residents against climate change as well as health disparities. Neglect of UGS can make those spaces unwelcoming and even dangerous, resulting in non-use [26].

Many health benefits come from the prevalence and use of green spaces, including physical, mental, and social well-being. The exact parameters necessary to obtain these benefits are important to take into consideration when planning, expanding, or maintaining UGS. Questions -- such as how much UGS is needed, how often should individuals visit UGS, and how accessible should UGS be for local residents to reap the benefits -- offer insight into what these parameters should be. The objective of this literature review is to answer these questions and provide insight into methods to promote equitable access to spaces that nurture the health of urban communities.

Health Benefits of Urban Green Spaces

Physical Health

Access to green space was associated with better cardiovascular health, as demonstrated in China by Leng et al. (2020). They found that areas with low Green Space Ratios were associated with higher rates of physical inactivity, overweight or obesity, hypertension, and stroke risk. Additionally, communities with a low Green Vision Index had higher rates of physical inactivity, overweight or obesity, hypertension, dyslipidemia, and stroke risk [21]. A Green Vision Index refers to the ratio of green space in one's field of vision; however, it is unclear what type of green space (e.g., sports field, park) is best for obtaining these results.

Green spaces also promote healthy lifestyles, particularly among older individuals. Astell-Burt et al. (2014) found that adults 45 years of age and older were significantly more likely to walk and perform moderate-to-vigorous physical activity if they lived in greener areas. This frequency increased in accordance with the amount of accessible green space. Activities such as walking in green spaces have a stronger role in reducing blood pressure than walking along an urban sidewalk [14]. Increasing physical activity in green spaces may therefore reduce the prevalence of cardiovascular-related risk factors and mortality rates.

It is important to highlight that tree canopy may also play a role. Astell-Burt and Feng (2020) conducted a longitudinal study in Australia to determine if the amount of tree canopy coverage and total green space within 1.6 km (1 mile) of residents affected the incidence and prevalence of doctor-diagnosed diabetes, hypertension, and cardiovascular disease. The authors identified that the baseline prevalence for these diseases was 6.8%, 39.0%, and 12.3%, respectively [2]. Once the data was adjusted for age, sex, income, economic status, couple status, and educational level, statistical analysis indicated that the odds of prevalent diabetes, hypertension, and cardiovascular disease were significantly lower with higher tree canopy within 1.6 km. The greatest reduction in the prevalence of disease was when tree canopy coverage was ≥30% (4.86%, 36.73%, and 11.37%). Thus, increased urban tree canopy may aid in the prevention of cardiometabolic diseases.

Researchers have conducted studies to determine if green space lowers the prevalence of obesity. Factors such as scale, accessibility, frequency of use, and vegetation cover, influence the potential benefits of green space in lowering obesity in urban settings. Studies suggest that if urban green space is highly accessible, there is a significant negative correlation with BMI, as residents often use it for physical activity [29]. A study in Spain showed that living in greener residential areas and closer proximity to forests was linked with less sedentary time and reduced risks of obesity in children [12]. Lachowycz and Jones (2011) conducted a systematic review of studies from the United States, Europe, Canada, Australia, and New Zealand, and found that 68% of the studies showed a positive association between green space and decreased prevalence of obesity.

It is important to stress that sociodemographics, such as age, gender, socioeconomic status, and disability may distort the association between UGS and obesity. When Mowafi et al. (2012) observed groups that varied socioeconomically, accessibility to green space did not have a significant effect on BMI. Rather, the authors suggest that the main factor that affected the prevalence of obesity among low SES groups was poor diet. Sander et al. (2017) observed that the benefits of green space differed according to one's gender and age, and that female and younger groups saw the most benefits. More research needs to be done to understand how the association between green space and obesity may vary among different subpopulations.

Mental Health

Mental health disorders account for 13% of the total global disease burden, which in 2010 cost an estimated $2.5 trillion globally. This number is only estimated to increase over time, rising to as much as $6.0 trillion by 2030, unless interventions are implemented. Gascon. et al. looked at this issue on a community level, focusing on the environmental factors of urban green spaces and their association with mental health indices [13]. Across various studies, green space in various forms including parks, recreational areas, and tree canopies was associated with self-reported lower prevalence and incidence rate of psychological distress (including anxiety and depression), higher quality of life, as well as better over health [1, 5, 8, 13, 25, 30, 34]. According to the CDC's publicly available National Environmental Public Health Tracking Network (NEPHTN), 86% of Baltimore City residents and 51% of Baltimore County residents lived within one-half mile of access to parks in 2015 (Figure 1) [24].

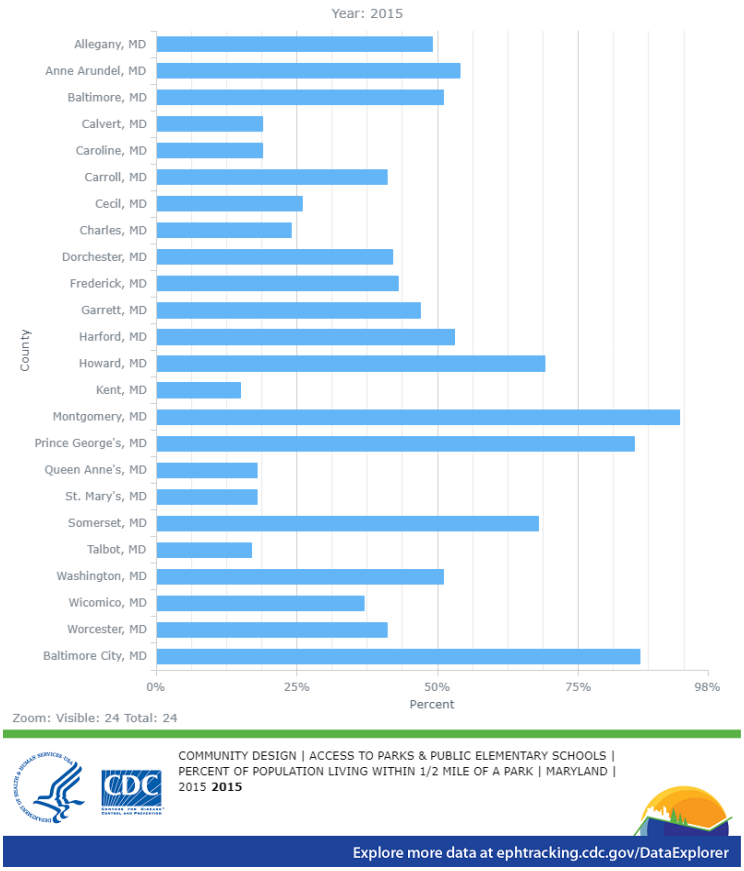

Figure 1: National Environmental Public Health Tracking Network (NEPHTN) access to parks & public elementary schools | percent of the population living within 1/2 mile of a park| Data showing 24 specified Maryland Counties.

When adjusted for age, sex, income, and economic status, exposure to 30% or more total green space was associated with a lower incidence of psychological distress [1]. Similar studies suggest that street trees and tree canopy positively affect mood and mental health. Feifei Bu et al. examined the association between green space and rising anxiety symptoms in 19,848 urban residents for over 20 months. They found that living in areas with higher canopy coverage was associated with fewer anxiety symptoms independent of population density, area deprivation levels, socio-demographics, and health profiles. They also found that feelings of worthlessness and depression were significantly lower in areas where greening interventions took place such as clean-ups and vacant lots conversions compared to areas where interventions did not take place (2022).

Social Health

Urbanization and lifestyle changes have limited the opportunities for human contact with nature in urbanized societies. However, UGS may remedy this negative consequence of urban dwelling. Green space serves as areas where communities can gather for recreational activities, social events, physical activity, and leisure/relaxation, and social interactions may be high depending on green space location and sociodemographic variables [27]. Green spaces are particularly useful in cities because, as the population grows and moves into urban environments, greenery often gets replaced with impervious surfaces, decreasing one's chance of interacting with nature.

Numerous studies suggest that social well-being is positively associated with the quality and amount of urban green spaces [15, 16]. To maximize social cohesion and foster a sense of community, the following factors should be considered: 1) the design of open parks, 2) increasing availability of sidewalks, 3) improved access to parks using public transportation, 4) increasing shaded areas in parks, and 5) maintaining playgrounds safe and functional [16]. Thus, when implementing green spaces, amenities, accessibility, and other features of the surrounding built environment may affect socialization and how often UGS are used by communities. These factors should be considered by policymakers and urban planners.

Recommended Amount of Urban Green Space

The 3-30-300 Rule to Urban Planning

The 3-30-300 Rule for urban planning was introduced by Cecil Konijnendijk in 2021 after an extensive review of current guidelines and data from urban green space planning. The rule presents the idea that every individual should have a line of sight to at least 3 trees outside their home or workplace,

every neighborhood should have 30% canopy coverage, and every individual should be within 300m of a large green space (~1 hectare), to see health benefits [19]. Line of sight to three trees is general guidance, research shows viewing larger, more developed trees provide more benefits than smaller ones. In areas where large trees may not be possible, any amount of vegetation will provide benefits.

Through Konijnendijk's literature review of current policy, he found that health benefits are seen at a minimum of 30% canopy coverage for neighborhoods [19]. It is important to note that this is 30% coverage per neighborhood and not overall for the city so individuals living throughout an area should have the same access to health benefits. Access to larger green spaces reduces the risk of cardiovascular disease and allows a gathering space for community organizations and recreational activities [19].

Traditional GIS technology has been used to assess canopy coverage and access to green spaces in cities but does not accurately capture the full picture because it fails to account for characteristics of the green space that affect perception and usage such as congestion or barricades to access [33]. Community science questionnaires could be deployed to better estimate residents' perception of their access to green space and gain community input while preparing urban green space policy. Involving the community in the design of urban green space is important to ensure access and continued maintenance of the space. Working together with the community can ensure that the plan works to undo problems of environmental injustice and provides the community with the resources they need [33].

Assessing Where Baltimore is Now and Where to Improve

Large disparities throughout different Baltimore neighborhoods' access to greenspace highlight environmental justice issues. Baltimore boasts 22.5 acres of green space per 1000 people, above the national average of 6.25 to 10 acres of parkland per 1,000 people. However, the distribution and use of the land do not impact all residents equitably [26]. An analysis by Boone et al. (2009) showed that Black residents had the highest accessibility to green spaces, but that those spaces were smaller and overused. Black residents are more likely to live in more densely-populated neighborhoods, and those neighborhoods tend to have a shorter walking distance to parks, but the parks are smaller and fragmented. The park acreage per 1000 Black residents is much lower (12.75 acres) than that of White residents (53.02) [26]. This increases park congestion in dense neighborhoods already lacking green space.

Due to the history of redlining and segregation in the City of Baltimore, densely-populated, predominantly black neighborhoods were often overlooked when it came to planning large parks, playgrounds, and even street trees. Because of this, there is still a persistent problem that historically-black neighborhoods have little green space, and often the available green space has other environmental health concerns, including arsenic in the soil [26]. Due to this systemic problem, these neighborhoods continue to be disadvantaged. The Boone data was collected in 2009 but there has not

been a large change in the City's distribution and quality of green space since then [26]. Future urban planning should focus on assessing what neighborhoods have been historically disadvantaged and work to increase green space to meet 30% canopy coverage in these neighborhoods and consider options for larger green spaces in proximity to these neighborhoods, in addition to the allocation of funds for the maintenance and upkeep of existing spaces.

Recommended Length of Exposure to Urban Green Spaces

Research suggests that spending 120 minutes or more per week in nature has significant benefits to health and well-being as compared to those who are not exposed to nature during the week [32]. How 120 minutes of nature exposure is achieved does not impact the benefits, meaning exposure can happen all at once or in increments throughout the week. This can be achieved by walking in nature, going to parks, woodlands, beaches, etc. The positive relationship between nature exposure and health and well-being exists until 200-300 minutes of nature exposure. After this point, the benefits of exposure stop increasing [32].

If direct nature exposure is not possible for residents, one study suggests that even brief frequent views of nature can contribute to well-being and satisfaction [18]. This may be achieved by looking at greenspaces from windows or virtually. For example, children who exercised while watching scenes of nature on a screen for 15 minutes had lower blood pressure compared to children who did not view nature scenes during this period of exercise. Another study found that viewing urban green scenes digitally for five minutes caused significant physiological restorative effects compared to those who viewed an urban built scene [17]. Though, as listed above, real green space offers these same benefits and more such a climate change resilience.

Accessibility of Urban Green Spaces

Definition of Accessibility

When considering urban green space accessibility, it is important to clarify what accessibility means. Accessibility does not only consider whether an urban green space simply exists or not. It also requires that the space be physically and psychologically welcoming [6]. Accessibility is often thought of in terms of distance, but additional factors that might make urban green spaces difficult to access must also be evaluated [6]. The goal of accessibility to urban green spaces is to make community members feel welcome in a space they can easily reach and freely enter as well as safely use [6].

Requirements for Accessibility

The WHO recommends that urban residents access urban green spaces of at least 0.5-1 hectare in size within 300 meters of their homes, which compares to engaging in a 5-minute walk [31]. The Accessible Natural Greenspace Standard (ANGSt) and the Urban Green Spaces Task Force also recommend urban green spaces be located no more than 300 meters from a place of residence and that it should be at least 2 hectares [9,11]. While the size recommendation of urban green spaces may vary slightly across organizations, there is consensus on the distance required for urban residents to adequately access these spaces. Another requirement for the accessibility of urban green spaces is the elimination of barriers which can range from issues in policy implementation, insufficient planning, and poor management of urban green spaces. The next section explores some of these barriers.

Barriers to Accessibility

Some of the most influential barriers to accessibility stem from bureaucracy. A lack of availability of urban green spaces for community members to access is due in large part to conflicting interests and limited resources within local governments that oversee the implementation and management of most urban green spaces. Interest in other project developments such as housing and office spaces may lead to competition for already finite resources [6]. It is the responsibility of these agencies to decide which projects they dedicate time to and allocate funds for. Conversely, if a project does not have sufficient support, it is less likely to succeed; hence, a lack of funding and regulation needed to properly maintain urban green spaces presents a major barrier [6]. The conversation surrounding the built environment is often at odds with urban green space with city officials perceiving that they must choose between one of the other. Therefore, shifting this either/or mentality to a built environment with green space is required to bring about change.

Comprehensive planning of urban green spaces is another essential part of their success. Poor planning can result in physical and psychological barriers that can greatly hinder the accessibility of these spaces [6]. Physical obstacles like fences, roads, railways, densely built-up areas, proximity to industry or gated communities, entrance fees, and hours of operation make it difficult for some urban residents to freely access and feel welcomed and safe in these spaces [6].

Psychological barriers impact the perceived accessibility of urban green spaces. This type of barrier arises from unwritten social norms and negative feelings or associations with the UGS [6]. For example, suppose the green space is located in what a potential user perceives as an inhospitable area due to discouraging surroundings or company [6]. In that case, it can dissuade them from using the space [6].

Poor management of urban green spaces can make the space seem unappealing to potential users. Insufficient, faulty, and outdated equipment at playgrounds or outdoor gyms, a scarcity of essential or appropriate furniture like benches, footpaths, and trash cans as well as a lack of lighting discourage the use of green space [6]. Litter, overgrown paths, over-congestion, excessive noise from road, rail, or industry, foul odor from a sewage treatment plant, or exhaust gasses are unintended consequences of poor planning and management that decrease the attractiveness of urban green space.

Conclusion

Urban green spaces play an important role in promoting urban residents' health and safety, including physical, mental, and social well-being. Spending about 2 hours a week in at least half a hectare of green space located within 300 meters of residents' homes is ideal for observing the health benefits outlined in this paper. However, due to the uneven distribution of UGS, not all urban residents have the opportunity to access UGS to follow these recommendations and observe these benefits. This is a major environmental justice concern because it directly affects marginalized communities and their health.

Next Steps

Greater emphasis should be placed on the just preservation and fair accessibility of urban green space. Given their obvious health benefits, local governments are responsible for the proper maintenance and creation of these spaces to better serve their communities. UGS should be open, safe, and abundant. Considering different types of urban green space is necessary for planning in cities as street trees, urban parks, and larger forests all serve different purposes. Public policy should aim to include requirements to increase and maintain canopy coverage in densely populated neighborhoods, enhance accessibility while preventing eco-gentrification of neglected neighborhoods, and incentivize citizens to contribute to the creation of urban green spaces such as through the growth of green roofs or walls. The larger community should have a say in the planning and implementation of such policies that hope to shape and improve their quality of life. Everyone has the right to a healthful environment in which their needs are met equitably, and urban green spaces are a vital tool in achieving this goal.

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