



Review of Impact of Urban Park Green Spaces on Residents' Health

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Abstract. This paper reviews the impact of urban park green spaces on residents' physical and mental health and systematically analyzes the research findings in this area. Specifically, the influence of urban park green spaces on physical health is manifested through the provision of exercise and leisure spaces and the improvement of air quality (via plant absorption of harmful gases and particulate matter), thereby reducing the incidence of cardiovascular and respiratory diseases. Regarding mental health, park green spaces, through the configuration of plant landscapes, help alleviate stress, enhance mood, and reduce anxiety. They also provide spaces for social interaction, fostering a sense of community belonging and effectively lowering the occurrence of mental health issues such as depression and anxiety. This paper also explores the various factors that influence the health benefits of park green spaces, summarizes the existing research status, and proposes suggestions for future research directions and urban green space planning, aiming to provide theoretical support for subsequent research and policy development.

Keywords: Urban park green spaces, health benefits, plant landscapes, green space planning

1 Introduction

With the continuous improvement of social productivity and technological levels in China, the process of urbanization is accelerating. Cities are expanding in scale, with increasing population densities, dense buildings, and diverse production and living activities. However, the rapid development of the economy and society has also led to many negative effects. For instance, industrial production and vehicle exhaust emissions have increased greenhouse gas emissions, resulting in frequent smog and acid rain. The dense construction of buildings has altered soil structure, increased surface runoff, and led to water quality deterioration. In addition, urbanization has triggered social issues such as traffic congestion, housing shortages, employment difficulties, and challenges in children's education and elderly care, which have severely affected residents' physical and mental health. In recent years, the number of urban residents suffering from respiratory, gastrointestinal, and cardiovascular diseases has significantly increased, and mental health issues arising from life stress have become more severe,

even showing a trend toward affecting younger age groups. As a result, the quality of life for urban residents has become a social focus.

Against the backdrop of rapid urbanization, Chinese cities face numerous health challenges due to the rapidly changing urban environment and lifestyle. There remains a significant imbalance in the development of urban environmental health.^[1] As an essential part of the urban green space system, park green spaces play a unique and crucial role in promoting the construction of socialist ecological civilization. Studies have shown that park green spaces can effectively regulate the local climate, reduce noise and air pollution^[2], mitigate environmental issues during urbanization, and create a pleasant urban living environment. Simultaneously, by encouraging physical activity and facilitating social interactions, park green spaces can effectively relieve emotional stress and improve residents' mental health.^[3]

As a typical public recreational area and an integral part of the urban ecosystem, urban park green spaces should play their inherent ecological service functions. The report from the 20th National Congress clearly states that "Chinese-style modernization is the modernization of harmonious coexistence between humans and nature." Given the growing prominence of physical and mental health issues among urban residents today, researching the impact of urban park green spaces on residents' health is of significant reference value for the systematic planning of urban green spaces and the rational design of park layouts. This research not only offers irreplaceable guidance in reflecting humanistic care but also provides scientific evidence for the formulation of public health policies.

This paper aims to systematically summarize and analyze the existing research in this field, examining how different configurations of plants, structures, and other elements in urban parks affect the physical and mental health of residents across various age groups and their mechanisms of action. The goal is to provide reference and inspiration for urban planning, public health, and psychology-related research and to fully leverage the ecological service functions of urban park green spaces, providing residents with better spaces for rest, relaxation, and physical exercise, thus improving the overall health of urban populations. The essence of national modernization lies in human modernization, and research into the impact of urban park green spaces on residents' health contributes to strengthening the country's ecological civilization goals, ensuring that the benefits of sustainable economic and social development reach the people, and ultimately achieving human sustainable development.

2 Literature Review

2.1 Functions and Types of Urban Park Green Spaces

Urban park green spaces refer to publicly accessible green areas that provide diversified outdoor activity spaces and complete recreational and service facilities. These spaces are an essential part of urban ecosystems. They not only serve basic leisure and recreation functions but also fulfill ecological protection, landscape beautification, cultural education, and emergency shelter roles. Based on their functions and uses, urban park green spaces can be categorized into four main types: comprehensive parks, community

parks, specialized parks, and garden parks, each with its unique features. The "Design Specifications for Parks in the People's Republic of China (2017)" clearly outlines the requirements for green coverage and functional facility configurations, providing a scientific basis for fully realizing the ecological service functions of these spaces.

As a vital carrier of urban ecological civilization construction, urban park green spaces provide diverse ecosystem services. They not only effectively alleviate environmental issues like air pollution and the urban heat island effect but also offer comfortable public spaces and fitness and recreational facilities to meet the physical and mental health needs of residents. Recent studies confirm that urban park green spaces play a significant role in improving the ecological environment, enhancing physical and mental health, and promoting social interactions.

The plants in green spaces absorb carbon dioxide and release oxygen, improving air quality. Vegetation coverage significantly mitigates the urban heat island effect and noise pollution, creating a pleasant living environment. Additionally, green spaces encourage residents to engage in physical exercise and outdoor activities, effectively reducing the risk of chronic diseases like cardiovascular diseases and obesity. The natural landscapes of parks also alleviate stress, reduce anxiety and depression, and improve residents' psychological well-being. As essential public spaces, parks foster social interactions, enhancing community cohesion and cultural identity. However, issues such as uneven regional distribution and insufficient functional adaptation in current green space planning and management need to be addressed through balanced resource allocation, diversified facility design, and intelligent management technologies.

Research on the impact of urban park green spaces on residents' health is of great theoretical and practical significance for promoting urban green development, improving public health policies, and enhancing residents' quality of life. Future studies should focus on establishing quantitative evaluation mechanisms to comprehensively measure the specific impacts of park green spaces on residents' health, explore the mechanisms behind these effects, and encourage interdisciplinary research in urban planning, ecology, and psychology. Through scientific park green space planning and management, urban ecosystems can be optimized, providing residents with better spaces for rest, exercise, and social interaction, thus contributing to the sustainable development of the economy and society and achieving the harmonious coexistence of humans and nature.

2.2 Impact of Park Green Spaces on Physical Health

Urban parks not only provide high-quality recreational and entertainment spaces but have also become an important platform for promoting public health due to their ongoing improvement in facilities. With the increased emphasis on residents' health by the state and society in recent years, the construction of fitness trails and sports facilities in parks has become increasingly comprehensive, providing residents with more convenient exercise and fitness conditions.

Studies have shown that park green spaces have a significant impact on improving public physical health. On one hand, parks provide ample outdoor activity space that encourages physical exercise, helping to reduce the incidence of chronic diseases such as obesity and cardiovascular diseases, thereby directly promoting physical health. On

the other hand, park green spaces improve residents' health indirectly through their ecological functions. For example, plants in green spaces help alleviate the urban heat island effect and the greenhouse effect, improving microclimate conditions. By adsorbing pollutants, they reduce harmful substances in the air, achieving air purification. Furthermore, by reducing noise pollution and beautifying the environment, they improve residents' quality of life. These ecological benefits work together to enhance the overall contribution of urban parks to human health.

Walking and jogging on primary park paths are ideal aerobic exercises. Studies have shown that regular aerobic exercise can effectively improve cardiovascular and pulmonary functions, enabling the cardiovascular system to transport oxygen and nutrients more efficiently throughout the body and increase muscle strength^[4], thus preventing high blood pressure, coronary heart disease, and other cardiovascular conditions. Additionally, walking exercise can increase cells' sensitivity to insulin, promote glucose absorption and utilization by peripheral tissues, improve glucose tolerance in obese patients, and reduce the incidence of obesity and diabetes.^[5] For instance, adults who walk for 30 minutes a day can reduce the incidence of diabetes by 50%.^[6] Moreover, urban parks positively affect specific populations, such as pregnant women and the elderly. Parks significantly improve the health of pregnant women, reducing maternal and perinatal mortality rates.^[7] They also provide excellent venues for elderly people to engage in group activities, such as square dancing, chess, and mahjong, which help strengthen bones and muscles, improve balance, enhance cardiovascular and immune system functions, and slow the aging process.^[8] Data indicates that green space area is positively correlated with life expectancy across different regions of the country (see Figure 1-3). This demonstrates that urban park green spaces significantly improve the health of residents across various age groups.

Urban parks are home to a variety of plant species and beautiful landscapes, serving as "natural oxygen bars" in cities, with important ecological environmental benefits. First, plant leaves release water through transpiration, dissipating heat and effectively alleviating the urban heat island effect, thus reducing urban temperatures. Second, green plants absorb carbon dioxide and release oxygen through photosynthesis, contributing to the urban carbon cycle while providing residents with fresh air and reducing the "greenhouse effect." In addition, plants can absorb nitrogen oxides, sulfur compounds, and particulate pollutants like PM2.5 from the air, effectively reducing the concentration of toxic gases in the air, thereby purifying the air. This purification function not only improves air quality but also reduces the risk of respiratory diseases and significantly protects public respiratory health. Moreover, certain large-leaved trees (e.g., sycamore, phoenix trees, and poplars) have special ecological functions. These plants can reduce wind force and noise through their leaves and trunks, as well as increase air humidity, which helps prevent respiratory diseases and provides suitable outdoor spaces for physical activity. Urban park green spaces also offer a variety of venues for physical exercise, such as fitness paths and open lawns, where people can engage in running, walking, and other physical activities. These exercise venues are beneficial for improving cardiovascular health, preventing diabetes, enhancing endurance, and promoting general health.



Fig. 1. Green coverage rate in various provinces of China (2024)



Fig. 2. Urban green space data of China (2024)

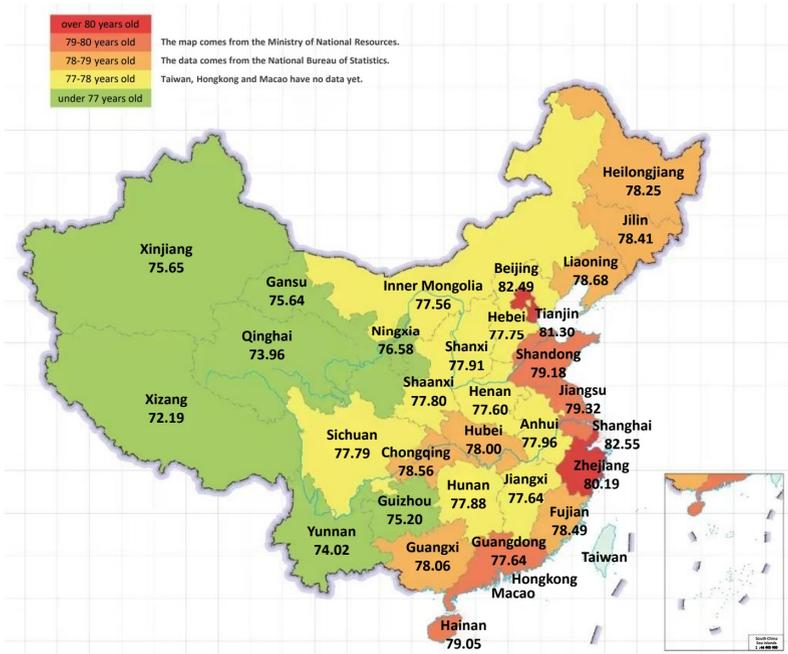


Fig. 3. Per capita life expectancy in various provinces of China (2020)

2.3 The Impact of Park Green Spaces on Mental Health

In urban ecological environments, the impact of park green spaces on human mental health has garnered widespread attention. Mental health, defined as the positive or normal state of an individual’s psychological activities, encompasses various aspects such as self-awareness, social adaptation, emotional stability, and personality structure.^[9] Park green spaces, through their environmental characteristics, particularly in attention restoration, stress relief, and mental state improvement, have become important factors in promoting mental health within urban ecosystems.

On one hand, park green spaces enhance people’s emotional regulation and psychological well-being through their multi-sensory design, which amplifies people’s experience of the environment. Design elements such as "sensory gardens," horticultural therapy, and meditation spaces, which stimulate multiple senses (touch, smell, sight, hearing), encourage intimate contact with nature and enhance emotional states.^[10] For example, the colors of plants in parks create different visual effects that, to some extent, influence people’s psychological feelings and emotional associations. Warm colors (such as red, orange, yellow), due to their higher brightness and vibrant tones, generally evoke cheerful and energetic psychological experiences, symbolizing hope and vitality. Cool colors (such as blue and purple) create a calm and distant atmosphere, promoting relaxation and psychological stability. Green, as the color of nature, when combined with other colors, offers a soothing effect, providing tranquility and comfort. What’s more, the color of the night lighting in the parks also significantly affects individuals’

emotions. High-intensity cold light may make people feel nervous, while warm light makes people feel tired and less motivated. In contrast, colors with intermediate temperature and illuminance do positive jobs in improving people's mood.^[11]

In addition, fragrant plants in parks, such as lilacs, wintersweet, magnolia, and begonia, have a positive impact on mental health. Their flowers' scents help calm emotions and reduce psychological stress, particularly during their flowering periods, when the intensity of their fragrance significantly affects emotional regulation. Some parks have created "healing gardens" by planting aromatic herbs like rosemary, lavender, and basil, utilizing horticultural therapy to help people achieve psychological balance and relaxation.^[12]

Auditory elements, such as birdsong, flowing water, and artificially added background music, form a soundscape that blends nature with human intervention. These sounds create a peaceful and relaxing atmosphere, positively affecting cognitive abilities, memory, and imagination. Studies have shown that sound stimuli in park environments activate neural mechanisms related to emotional regulation and psychological restoration, helping individuals relieve stress and enhance mental resilience.

The "20-minute park" effect is one of the significant findings in recent research on the relationship between park green spaces and mental health. This theory suggests that brief exposure to parks significantly lowers cortisol^[13] levels in the body and increases endorphin^[14] secretion, thereby alleviating stress responses and promoting emotional stability and psychological recovery. This effect provides strong evidence for ecological research, demonstrating the unique role of park green spaces in reducing the pressures of modern life and enhancing mental health.

As public spaces, parks serve multiple functions such as recreation, entertainment, and socializing, making them important venues for promoting social interaction and mental health. Social activities such as gatherings, picnics, and cultural events provide ample opportunities for socializing, indirectly improving individuals' mental health. This is particularly true for younger populations, where parks, as social platforms, help alleviate mental issues such as burnout and anxiety. By promoting social interactions and fostering a sense of self-identity and community belonging, parks significantly improve their psychological well-being.^[15] For elderly populations, parks not only offer spaces for leisure and entertainment but also help establish new social roles^[16], reduce feelings of loneliness, promote social support, and delay cognitive decline, improve emotional states, and enhance overall quality of life.

In summary, park green spaces contribute not only to the biological diversity and ecological services of urban environments but also effectively promote the mental health of urban residents through their diverse design and functions. As research in the intersection of ecology and psychology deepens, the role of park green spaces in enhancing urban quality of life and promoting social mental health will become even more significant.

2.4 Factors Influencing the Health Benefits of Park Green Spaces

The impact of park green spaces on both physical and mental health is regulated by the interaction of various factors. Existing research indicates that the health benefits of park

green spaces are mainly influenced by three types of factors: 1) the type and physical characteristics of the park, 2) residents' usage characteristics, and 3) residents' perceptions and experiences of the park environment. These three factors—each from the perspectives of the park's objective attributes, residents' subjective behaviors, and the interaction between people and the environment—provide different forms and qualities of ecosystem services, thereby having a profound impact on health benefits.

In terms of physical characteristics, factors such as the park's size, vegetation density, species diversity, and color variety directly affect the health benefits. Different types of parks have significant differences in their physical characteristics, which results in varying health benefits. For example, comprehensive parks located in city centers typically have larger green areas, richer plant species, and diversified functional zones, which can effectively promote social interaction and improve relationships, thus having a significant positive impact on residents' health. In contrast, community parks primarily serve residential areas and offer more limited social spaces. Research has also shown that small urban green spaces, such as pocket parks or small recreational areas on streets, although smaller in size, can still significantly reduce stress and restore physical energy, offering certain health benefits.^[17] Recently, there has been increasing attention to age-friendly and child-friendly pocket park designs, and the increase in such parks is helping to improve the health conditions of special groups such as the elderly and children.

The choice and arrangement of plants in parks also significantly affect residents' health. Studies have shown that the healing effects of green spaces are positively correlated with vegetation density, with forests exhibiting the most significant therapeutic effects, followed by grasslands, and squares showing relatively weaker effects.^[18] Additionally, the color changes in dense forests should be appropriately reduced, and using a uniform green tone can enhance the therapeutic effect; in lawn areas, increasing species diversity and color variety helps improve residents' landscape preferences. For square areas, appropriately increasing plant coverage can significantly enhance health benefits. Further research has demonstrated that using a multi-layered configuration of trees, shrubs, and herbaceous plants can effectively reduce air pollutants such as PM_{2.5} and provide optimal comfort, thus promoting residents' physical health.^[19]

The usage characteristics of the park are also an important factor affecting health benefits, including frequency of use, duration of stay, and types of activities. The accessibility of the park significantly influences its usage frequency, especially for younger groups, where distance is often a primary factor limiting park use.^[20] The closer residents live to a park, the more frequently they use it and the longer they stay, resulting in more noticeable positive health effects. The functional zoning and supporting facilities in the park enrich activity forms, providing residents with diverse spaces. Sports-friendly parks, for example, not only provide dedicated children's and elderly activity areas but also significantly promote physical health. Activities such as gatherings, conversations, meditation, and gardening in parks also positively impact residents' mental health.

Finally, the spatial organization and landscape design of parks play an important role in the health benefits. Different spatial layouts and landscape styles can evoke different aesthetic experiences, which, in turn, influence psychological health. Research has

shown that environmental interactions—whether transient or stationary—have a significant positive effect on mental health, especially in fragmented patchy green spaces and large open water surfaces, which attract residents to engage in activities, thereby enhancing health benefits.^[21] Additionally, the internal spatial organization of parks affects visitors' activity routes; excessively long paths or large distances between facilities may reduce residents' willingness to engage in activities, affecting their overall park experience and health benefits.^[22]

By thoroughly studying the characteristics of park green spaces and their mechanisms of impact on residents' health (as shown in Table. 1), scientific guidance can be provided for urban planning and park design, promoting both ecological environmental improvements and public health.

Table 1. Summary of health benefits and influencing factors of park green spaces

Influencing Factors	
Physical Characteristics	Area of Green Space
	Vegetation Density
	Species Diversity
	Color Variety
Usage Characteristics	Usage Frequency
	Staying Duration
	Activity Types
Perception Characteristics	Spatial Layouts
	Landscape Styles
Health Benefits	
Physical health	Cardiovascular and Pulmonary Function Enhancement
	Diseases Prevention
	Skeletal Muscle Strength Increase
	Sleep Quality Improvement
Mental Health	Happy Mood Maintenance
	Attention and Memory Enhancement
	Working Pressures Relief
	Mental Illnesses Prevention
	Good Interpersonal Relationships Maintenance
	Life Happiness Improvement

3 Research Status and Trends

3.1 Current Research Status and Future Trends

In recent years, scholars both domestically and internationally have conducted extensive and in-depth studies on the impact of urban park green spaces on residents' health, leading to fruitful research outcomes. The current research status exhibits several notable characteristics:

1. Increasing Diversification of Research Methods

The primary methods in the data collection phase include surveys, where the basic attributes of park green spaces are usually studied through field investigations and remote sensing observations, while residents' physical and mental health conditions are obtained via questionnaires. During the data analysis phase, scholars commonly use linear regression models to explore the relationships between influencing factors and residents' health. Furthermore, many researchers use standardized scales, such as BMI (Body Mass Index), PANAS (Positive and Negative Affect Schedule)^[20], and SWEMWBS (Warwick-Edinburgh Mental Well-being Scale)^[21], to assess residents' mental health, and apply control variable methods for further analysis. The research outcomes are typically presented in bar charts, line graphs, and scatter plots to visually illustrate the correlation between various influencing factors and health conditions. Additionally, some scholars use landscape rendering software like Lumion^[17] and Mars^[1] to simulate different park green space scenarios, studying residents' perceptions and preferences of landscapes, thereby assessing the psychological healing effects of different types of green spaces.

2. Expanding Dimensions of Research

Current research not only focuses on residents' physical and mental health but increasingly emphasizes social health. Scholars have gradually expanded the dimensions of analyzing the health benefits of park green spaces, considering factors such as park types, green space coverage, accessibility and exposure levels for residents, plant configurations, spatial organization, and aesthetic perceptions. These studies comprehensively explore the multidimensional impacts of park green spaces on residents' health.

3. Increasing Precision in Research Subjects

With growing attention to the health needs of elderly people, children, adolescents, and people with disabilities, research on specific groups' health benefits has become an important development direction. New forms of parks, such as child-friendly parks, age-friendly parks, healing parks, and accessible parks, are receiving increasing attention. Studies show that there are approximately 400 articles on age-friendly green spaces, 164 articles on green space exposure for adolescents, and 357 articles on child-friendly green space planning, with a noticeable increase in recent publications. This trend reflects growing attention to human care and the promotion of comprehensive and sustainable social development.

3.2 Future Research Trends

(1) Popularization of Interdisciplinary Research

The mechanisms through which park green spaces impact residents' health are complex and multidimensional, involving biological, psychological, and social aspects. Therefore, future research needs to rely on multidisciplinary theories and practices, including landscape ecology, biology, psychology, sociology, and even emerging technologies like artificial intelligence, to explore the relationship between park green spaces and residents' health.

(2) In-depth Exploration of Micro-mechanisms

Currently, the specific mechanisms through which park green spaces influence health are not yet fully understood. Future research should focus on micro-mechanisms, such as how different colors and landscape configurations affect residents' psychological states through visual and sensory effects, how volatile and aromatic substances released by plants affect the nervous and immune systems, and how social interactions within parks regulate hormone secretion to promote mental health. Gaining a deeper understanding of these micro-mechanisms will provide theoretical support and practical guidance for park green space design, landscape planning, and the organization of residents' activities.

(3) Dynamic and Long-term Research Processes

Existing research is primarily cross-sectional, with relatively short durations. Most studies analyze park types and their users' health statuses to explore the relationship between green space attributes and health. Future research will likely shift towards longitudinal studies, involving long-term observations of specific parks and their users. Such studies will investigate the dynamic changes in health benefits across different seasons and life stages. Additionally, park renovations and optimizations can be compared before and after modifications to assess the changes in health benefits, providing valuable experience for future park planning and design.

(4) Comprehensive and Collaborative Benefit Evaluation

Future research will increasingly involve comprehensive assessments, covering all aspects of residents' physical and mental health. In particular, studies will examine how multi-dimensional factors, such as plant configurations, color schemes, facility arrangements, and spatial layouts, work in synergy to affect residents' health. Moreover, there will be a focus on promoting the holistic characteristics of park green spaces as ecosystems, fostering the integration of public health and urban ecological civilization.

4 Conclusion

In summary, urban park green spaces have a significant positive impact on residents' physical and mental health. Specifically, park green spaces improve physical health by providing spaces for physical activities, enhancing air quality, and optimizing natural landscapes. At the same time, by designing elements such as color schemes, plant configurations, and social interaction spaces, parks help residents regulate emotions, alleviate anxiety, improve interpersonal relationships, and promote psychological well-being. The realization of health benefits from park green spaces is influenced by multiple

factors, including park type and physical characteristics, landscape design and spatial layout, residents' frequency and duration of use, and their perceptions and experiences of the park environment.

In the context of rapid urbanization and population aging, social welfare issues are increasingly emphasized. In the future, research on the health benefits of urban park green spaces will become even more in-depth, especially focusing on the health needs of specific groups such as the elderly, children, and adolescents. Further exploration of how park green space elements influence the health of different populations will provide theoretical foundations for urban park landscape design and green space system planning. This research will also contribute to better serving residents' health, supporting the goals of ecological civilization construction in China, and advancing the construction of a "Beautiful China" and a "Healthy China."

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