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Design and Evaluation of Urban Green Corridors for Enhancing Physical and Mental Health of City Dwellers

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ABSTRACT

This research aimed to provide a comprehensive overview of how urban green corridors could be effectively designed and implemented to enhance the physical and mental health of city dwellers, as well as improve the overall sustainability and liveability of urban areas. By analysing data from existing sources and case studies, the study found that the incorporation of diverse and well-designed green infrastructure into urban planning and development can greatly enhance the sustainability, resilience, and overall liveability of urban areas. Well-designed urban green corridors were shown to promote physical activity, social interaction, and restorative experiences, leading to improved mood, general well-being, and stronger community ties. The study emphasizes the importance of considering ecological quality and biodiversity when creating these green spaces, as variations in flora and fauna can significantly impact the degree of health and psychological benefits. The findings strongly support the idea that strategic planning and design of multifunctional green infrastructure that caters to the diverse needs of urban residents is crucial for building more liveable, sustainable, and resilient cities that prioritize the overall well-being of their citizen.

KEYWORDS: *Physical, mental, sustainability, liveability, biodiversity, community, resilience.*

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1. General Introduction

Urban green corridors, strategically designed networks of green spaces, represent a promising approach to enhance the well-being of city dwellers by integrating natural elements into the built environment (Andreucci et al., 2019). These corridors, which include parks, greenways, and other vegetated areas, offer a multitude of benefits, contributing to both physical and mental health improvements for urban populations (Nguyen &Cicea, 2021). The availability of green spaces provides opportunities for outdoor physical activities, social interactions, and relaxation, serving as a crucial environmental determinant of urban residents' health (Berg et al., 2015). Urban green spaces are essential not only for recreation and aesthetic appeal but also for their significant role in promoting public health (Zhang et al., 2020). As urbanization continues to intensify, with an increasing proportion of the global population residing in cities, the need for innovative strategies to mitigate the adverse health effects associated with urban living becomes ever more critical. (Groenewegen et al., 2006). The incorporation of green infrastructure into urban planning is paramount to creating sustainable, healthy, and resilient cities that can adapt to the challenges posed by climate change and increasing population density. Furthermore, urban vegetation positively influences mental health and well-being, potentially offsetting the adverse health repercussions of high temperatures (Nazish et al., 2024).

1.1. The Multifaceted Benefits of Urban Green Corridors

Urban green corridors offer a wide range of benefits that extend beyond mere aesthetics, influencing various aspects of human health and environmental sustainability (Lee et al., 2015). One of the most significant advantages of urban green corridors is their ability to promote physical activity among city residents. These corridors provide accessible spaces

for walking, running, cycling, and other forms of exercise, encouraging a more active lifestyle and combating sedentary behaviour, a major risk factor for chronic diseases. The presence of green spaces encourages the use of outdoor spaces, increasing the interaction and social integration among citizens (Virtudes, 2016). Furthermore, green corridors contribute to improved air quality by filtering pollutants and reducing the urban heat island effect through evapotranspiration. Plants within green corridors absorb carbon dioxide and release oxygen, helping to reduce greenhouse gas concentrations and mitigate climate change (Ochodo et al., 2014). The mechanical system, along with plants, helps break down toxins and contamination, mechanically collecting large plastic bags floating on the water (Zaman et al., 2022). By creating contiguous green spaces, these corridors enhance biodiversity and provide habitats for various plant and animal species, fostering ecological balance within the urban landscape.

Beyond physical health, urban green corridors have a profound impact on mental well-being. Exposure to nature has been shown to reduce stress, anxiety, and depression, while improving mood and cognitive function (Braubach et al., 2017). Green spaces offer a tranquil escape from the hustle and bustle of city life, providing opportunities for relaxation, meditation, and mindfulness practices. Additionally, green corridors can enhance social cohesion by creating shared spaces for community gatherings, events, and recreational activities, fostering a sense of belonging and social support (Gilbert, 2016). By providing cleaner air, energy security, healthier foods, sustainable and active transportation, and building more walkable, inclusive and livable cities and communities, green corridors promote health (Roca-Barceló et al., 2024). Urban green spaces play a vital role in mitigating heat-related health risks, offering a potential strategy for urban planning to address climate change and enhance public health (Nazish et al., 2024). The integration of blue and green spaces creates an interwoven urban open space system, yielding social and economic benefits, alongside crucial ecosystem service functions (Cheng et al., 2022).

1.2. Designing Effective Urban Green Corridors

The design of effective urban green corridors requires a holistic approach that considers various factors, including connectivity, accessibility, functionality, community engagement, and environmental sustainability. Connectivity is crucial for ensuring that green corridors link different parts of the city, creating a seamless network of green spaces that can be easily accessed by residents. Accessibility is another important consideration, as green corridors should be designed to be inclusive and accessible to people of all ages and abilities, with features such as ramps, accessible pathways, and seating areas. Functionality refers to the ability of green corridors to serve multiple purposes, such as providing recreational opportunities, supporting biodiversity, and mitigating environmental hazards. Community engagement is essential for ensuring that green corridors meet the needs and preferences of residents, fostering a sense of ownership and stewardship. It is also important that green corridors incorporate green infrastructure to provide ecosystem services, such as stormwater management, air purification, and carbon sequestration. The restoration of green spaces necessitates land-use and land-cover change monitoring, practical government physical planning interventions, and an inclusive strategy for managing the city's green spaces, involving NGOs, community organizations, and citizens to create thriving and sustainable urban environments.

1.3. Evaluating the Impact of Urban Green Corridors

Evaluating the impact of urban green corridors requires a multi-faceted approach that considers various indicators of physical and mental health, environmental quality, and social well-being. Physical health indicators may include rates of physical activity, obesity, and chronic diseases, while mental health indicators may include levels of stress, anxiety, and depression. Environmental quality indicators may include air and water pollution levels, temperature, and biodiversity. Social well-being indicators may include levels of social cohesion, community engagement, and crime rates. Spatial-explicit and ecological connectivity analyses of urban green infrastructure are helpful tools for planning and evaluating spatial patterns and their changes for the sustainability of urban development (Wang & Pei, 2020). Data should be collected through surveys, interviews, focus groups, and environmental monitoring to assess the effectiveness of green corridors in achieving their intended goals. By carefully analyzing the collected data, it is possible to determine the extent to which green corridors are contributing to improved health outcomes, environmental quality, and social well-being.

1.4. Challenges and Future Directions

Despite the numerous benefits of urban green corridors, their implementation faces several challenges, including competing urban planning priorities, economic constraints, and market forces (Lee et al., 2015). Overcoming these obstacles

requires quantified methods and regulatory reform (Dunn, 2010). Municipalities have focused efforts on designing and implementing ecosystem-services-based "green infrastructure" in urban environments to utilize green infrastructure services (Pataki et al., 2011). Future research should focus on developing innovative design strategies that maximize the benefits of green corridors while minimizing their costs. Furthermore, research is needed to understand the long-term impacts of green corridors on human health, environmental quality, and social well-being. Longitudinal studies are needed to track changes in these indicators over time. Future studies should also investigate the role of technology in enhancing the effectiveness of green corridors, such as using sensors to monitor air and water quality or using virtual reality to create immersive nature experiences. By addressing these challenges and pursuing future research directions, it is possible to unlock the full potential of urban green corridors. Green infrastructure plans are developed at different planning scales (Kranjčić et al., 2019). Landscape connectivity should be incorporated into spatial planning practice through regional planning (Rusche et al., 2019).

Despite recent developments, there is still no consensus among researchers and practitioners regarding the concept of green infrastructure as well as its implementation approaches, which makes it often difficult for urban planners and other professionals in the field to develop a robust green infrastructure in some parts of the world (Monteiro et al., 2020). To address this issue, urban planners and policymakers can work together to create policies and regulations that promote the development and integration of green corridors into the urban fabric, ensuring their long-term sustainability and effectiveness. By promoting sustainable urban development practices and prioritizing the health and well-being of city dwellers, urban green corridors can play a vital role in creating more liveable, resilient, and equitable cities for all. The study of urban green spaces and their various benefits to social, economic, and environmental well-being reveals a complex web that cities must carefully weave to create resilient and sustainable urban landscapes (Zhang & Qian, 2024). This is because different green spaces contribute to experiences of well-being in different ways for different people, highlighting the need for a comprehensive and context-specific approach to green infrastructure planning and management (Papastergiou et al., 2023). This should include understanding the potential negative impacts of green infrastructure, such as gentrification and displacement, and implementing strategies to mitigate these effects. To further expand on this, it is important to note that the design and implementation of urban green corridors should be guided by a holistic and inclusive approach that considers the diverse needs and preferences of local communities. This may involve engaging residents in the planning process, incorporating their feedback, and ensuring that the corridors are accessible and beneficial to people of all ages, abilities, and socioeconomic backgrounds. Additionally, the long-term sustainability of urban green corridors requires ongoing maintenance, monitoring, and adaptation to address changing environmental and social conditions. By adopting a comprehensive and collaborative approach to green infrastructure development, cities can unlock the full potential of urban green corridors to promote public health, environmental resilience, and social equity.

Integrating green spaces into urban environments requires addressing a range of multifaceted challenges, including the need for better policy integration, overcoming financial constraints, and ensuring equitable access for all city dwellers (Lee et al., 2015). Green infrastructure should be strategically used in urban areas to provide complementary solutions that address both environmental and human health concerns (Haq, 2011). Effective implementation of urban green corridors necessitates coordinated efforts across different sectors and levels of government, as well as meaningful engagement and collaboration with local communities and key stakeholders (Nshimiyimana et al., 2023). By adopting a comprehensive and inclusive approach, cities can unlock the full potential of urban green corridors to promote public health, environmental resilience, and social equity. In addition, incorporating small-scale green spaces into housing developments is essential to maintain existing compact settlement structures while expanding green infrastructure (Addas, 2023). It has been documented that compact cities may suffer accentuated loss of green space, increased traffic congestion, local air pollution, energy demand or vulnerability to urban heat island phenomena (Koroxenidis& Theodosiou, 2021).

Considering the multi-dimensional benefits of urban green spaces, it is imperative that urban planning and design prioritize the integration of green infrastructure to enhance the health and well-being of city dwellers (Haq, 2011). This requires a shift towards more sustainable and people-cantered approaches to urban development that recognize the intrinsic value of nature in promoting liveable, resilient, and equitable cities (Azhar et al., 2022).

There is also need for strategies that support the long-term maintenance and management of these green spaces, ensuring their continued functionality and benefits for future generations. To address the growing challenges of urbanization and climate change, many cities are turning to nature-based solutions, such as green infrastructure, to enhance resilience, improve public health, and promote environmental sustainability (Calheiros & Stefanakis, 2021; Pataki et al., 2011). One type of green infrastructure that is gaining increasing attention is the urban green corridor, which refers to a network of interconnected green spaces, such as parks, gardens, and green streets, that provide a range of ecological, social, and economic benefits (Virtudes, 2016; Wu et al., 2024).

Designing and evaluating urban green corridors requires a multi-faceted approach that considers various factors, including ecological connectivity, accessibility, recreational opportunities, and community engagement (Lee et al., 2015). In addition to the functional aspects of green corridors, their aesthetic and cultural values should also be considered in the design process. It is important to assess the social and environmental impacts of urban development, ensuring that green spaces are integrated into the planning process and contribute to the overall quality of life for city residents. The design of urban green corridors should prioritize ecological connectivity by creating continuous pathways that connect fragmented habitats, allowing for the movement of plants and animals (Gong & Deng, 2011). By incorporating diverse plant species, creating varied topography, and providing water sources, urban green corridors can provide valuable habitat for a wide range of organisms (Zaręba et al., 2019). Integrating grey and green infrastructure can be visualized by understanding their complex relationships which improves the health and well-being of urban populations (Svendsen et al., 2012).

Cities should consider the application of greener and more natural urban designs, such as through the implementation of garden city principles, which Favor the integration of nature and open green spaces within residential neighbourhoods. This would allow city residents to easily access and enjoy the benefits of these natural environments by being able to conveniently walk to them (Rojas & Jorquera, 2021). The ecological function of green infrastructure such as "green roads" and "green lines" is important in urban structure (Zhu et al., 2020). The potential contributions of vertical greenery systems have physical and non-physical benefits (Ghazalli et al., 2019). Green infrastructure are open spaces, natural areas, forests, parks, green streets, squares and public spaces; sustainable drainage systems, cycling and hiking trails within urban environments; to green roofs, walls and facades depending on the scale and typology they are envisaged (Olic & Stober, 2019). Green infrastructure provides many benefits, or ecosystem services, such as offering a recreational role in everyday life, playing an important part in conserving biodiversity, adding to the cultural identity of a city, easing and improving the environmental quality of the city, and providing natural solutions to technical challenges such as sewage treatment in cities (Guerrero et al., 2016).

Urban green spaces play a crucial role in mitigating the negative impacts of urbanization on human health and well-being. By providing opportunities for physical activity, social interaction, and exposure to nature, green spaces can help reduce stress, improve mental health, and promote overall well-being (Haq, 2011). These spaces contribute to the formation of a favorable urban environment for human activity, primarily by improving the environment through the absorption and decomposition of pollutants, regulation of temperature and humidity, reduction of electromagnetic field intensity, and enhancement of air structure due to bactericidal and fungicidal compounds (Finaeva, 2017). They further provide significant carbon sequestration as well as produce oxygen, both of which improve air quality (Zhang & Qian, 2024). Furthermore, strategically designed green corridors can enhance the aesthetic appeal of urban areas, increase property values, and stimulate economic development. Greenery in the city provides spaces for leisure and recreation which are important for quality of life (Iswoyo et al., 2019)(Łabuz, 2019)(Mwendwa &Giliba, 2012)(Ghazalli et al., 2018). Additionally, urban green spaces offer a range of other benefits, such as reducing runoff, improving water quality, and supporting biodiversity (Zhang & Qian, 2024)(Haq, 2011). Incorporating small-scale green spaces into housing developments can also help maintain compact settlement structures while expanding green infrastructure networks in urban areas. (Berg et al., 2015; Jabbar et al., 2021; Lee et al., 2015).

Urban areas face immense strain from urban sprawl, open space conversion, and environmental pressures like climate change and pollution (Gobster, 2010). There is evidence that well-managed urban green spaces support resident health and well-being, as well as wildlife populations, by moderating temperature, reducing air pollution, and offering chances for physical activity and relaxation (Mojiol et al., 2022)(Bertram &Rehdanz, 2015). Green spaces are

important for biodiversity primarily as wildlife refugia and wildlife movement corridors and are also genetic reservoirs (Jones & Leather, 2012). Public open spaces improve the townscape, offer ecological variety, promote the health of people, contribute to societal well-being, and deliver significant economic value, all of which enhance the quality of urban life (Skaržauskienė&Mačiulienė, 2019). Urban design significantly impacts the quality of life for city dwellers, especially their mental health (Olszewska-Guizzo et al., 2021). Access to green areas and alternative transportation options like cycling or walking greatly contribute to the overall well-being of people living in cities (Panagopoulos et al., 2015). Green infrastructure has become a vital element in land-use planning and urban design, offering a comprehensive strategy to address environmental issues and enhance the sustainability and resilience of urban areas. Urban green spaces are essential for promoting health and well-being, improving environmental quality, and creating more liveable and sustainable cities (Bertram &Rehdanz, 2015)(Mansor & Harun, 2014)(Nguyen &Cicea, 2021)(Muliasari et al., 2021). The integration of nature and open green spaces within residential neighbourhoods, such as through the implementation of garden city principles, can allow city residents to easily access and enjoy the benefits of these natural environments (Muliasari et al., 2021). Additionally, the incorporation of small-scale green spaces into housing developments can help maintain compact settlement structures while expanding green infrastructure networks in urban areas (Nguyen &Cicea, 2021). Urban green space is very vital in today's city development that meets the needs of urban communities in carrying out their various activities (Handy & Maulana, 2021). Parks have been recognized as major contributors to the aesthetic and physical quality of urban neighbourhoods, and offer economic, social, and environmental benefits to the community (Hashim et al., 2019).

The rise in urbanization and population density has placed increasing pressure on urban green spaces, highlighting the need for innovative approaches to urban planning and design. These spaces are viewed not just as recreational locations but as vital elements that significantly improve communities' and residents' quality of life (Moghadam et al., 2014). Integrating sustainability with green infrastructure is crucial, as green spaces offer important ecosystem services like lowering the urban heat island effect, managing stormwater, and enhancing biodiversity, all of which enhance the environment and promote more sustainable urban development (Gifford & Sussman, 2012). Urban green spaces, including parks, gardens, and green corridors, provide numerous health benefits, including decreased stress, better mental health, and more opportunities for physical activity. Exposure to even a small park on the way to work can positively influence mood, and these brief restorative experiences contribute to long-term health (Nordh et al., 2009). Incorporating ornamental plants into urban green spaces can further enhance their environmental and aesthetic value, contributing to climate change mitigation and providing essential ecosystem services (Orlóci& Fekete, 2023). As urban populations grow, it's essential to strategically plan and manage these spaces to ensure they meet the diverse needs of urban residents and contribute to the overall sustainability and resilience of cities (Ríos-Rodríguez et al., 2021). These natural spaces are intended for rest, relaxation, but also educational (Nowacka-Rejzner, 2019).

2. Research Methodology

The research methodology for this study was based on secondary sources and case studies of urban planning and urban development, as well as existing literature on green infrastructure and its effects on public health. Perceived Effect of Urban Park as a Restorative Environment for Well Being in Kuala Lumpur was used to gather an understanding of the topic. Parametric Architectural Solution to River Front Developments: Restoring River Ravi Lahore touched on the reconstruction of river front developments for the betterment of the environment. The Effects of Different Natural Environment Influences on Health and Psychological Well-Being of Pe was used to understand the psychological effect of green spaces. Not All Green Space Is Created Equal: Biodiversity Predicts Psychological Restorative Benefits From added depth to the importance of quality when considering the design of urban spaces. The case studies focused on cities that had successfully integrated green corridors into their urban fabric, examining the planning, design, and implementation strategies used. The data from these case studies was analysed to identify best practices and lessons learned. The success of urban green corridors depended on careful planning and community participation. Including a wide variety of stakeholders in the planning and design process helped ensure that the green space met the community's requirements and preferences. The implementation of sustainable practices was essential to guarantee the long-term effectiveness and viability of urban green corridors. This entailed using environmentally friendly building materials, cutting back on water use, and encouraging biodiversity in the area. Furthermore, a thorough assessment of the social, economic, and environmental effects of green corridors was necessary to comprehend their overall

value and impact on urban areas. Byanalysing data from existing sources and case studies, this research aimed to provide a comprehensive overview of how urban green corridors could be effectively designed and implemented to enhance the physical and mental health of city dwellers, as well as improve the overall sustainability and liveability of urban areas.

3. Findings

The incorporation of diverse and well-designed green infrastructure into urban planning and development can greatly enhance the sustainability, resilience, and overall liveability of urban areas. Cities that prioritize the strategic integration of high-quality green spaces, such as parks, gardens, and green corridors, tend to exhibit superior air quality, reduced urban heat island effects, and enhanced biodiversity. The presence of these naturalistic environments not only encourages physical activity and social interaction, which can lower feelings of loneliness and improve community ties but also provides restorative experiences that can elevate people's moods and enhance their general well-being. Furthermore, when creating urban green corridors, it is crucial to consider the ecological quality and biodiversity of these spaces, as variations in the richness and diversity of flora and fauna can significantly impact the degree to which people's health and psychological restoration are improved by accessing and engaging with these natural environments. By carefully planning and designing multifunctional green infrastructure that caters to the diverse needs and preferences of urban residents, city planners and policymakers can foster more liveable, sustainable, and resilient communities that promote the overall physical, mental, and social well-being of their citizens.

3.1. Discussion

The study's findings strongly support the idea that well-designed urban green corridors can significantly improve the physical, mental, and overall well-being of city residents. These green spaces not only promote physical activity and social interaction but also provide restorative experiences that enhance mood and general quality of life. Integrating sustainable green infrastructure into urban planning is crucial for creating liveable, resilient cities that meet the diverse needs of growing populations. The incorporation of these green corridors into urban areas can offer numerous benefits, including improved air quality, reduced urban heat island effects, and enhanced biodiversity. Additionally, these spaces encourage community engagement and foster a greater sense of connection among residents, which can lead to improved mental health and stronger social cohesion. By strategically planning and designing these green corridors, urban planners can create multipurpose spaces that cater to the diverse needs of the local population, from recreational activities to educational opportunities and ecosystem services. Ultimately, the integration of well-designed urban green corridors is a key component in building more sustainable and resilient cities that prioritize the health and well-being of their residents. These corridors can serve as vital hubs for community interaction, providing opportunities for physical exercise, social gatherings, and environmental education. They can also contribute to climate change mitigation efforts by improving air quality, reducing urban temperatures, and enhancing biodiversity. By carefully considering the diverse needs and preferences of residents, urban planners can design green corridors that truly meet the evolving requirements of growing urban populations and foster a greater sense of community and connection among city dwellers.

4. Conclusion

Urban green corridors are essential for enhancing the physical and mental health of city dwellers by providing spaces for recreation, relaxation, and social interaction. By deliberately incorporating green infrastructure into urban planning, cities can become more sustainable, resilient, and liveable for their inhabitants. Green spaces in residential areas have been linked to higher levels of neighbourhood satisfaction, underscoring the importance of perceived quality and accessibility. Creating and maintaining urban green corridors necessitates interdisciplinary collaboration between urban planners, landscape architects, public health specialists, and community members to ensure that these spaces effectively meet the diverse needs and preferences of the population they serve. Additionally, integrating ecological quality considerations into the design of urban green corridors can maximize their positive impacts on people's health and well-being, as access to higher-quality green spaces has been shown to yield greater restorative benefits. Further research is needed to explore the long-term impacts of urban green corridors on public health and environmental sustainability, as well as to identify innovative strategies for enhancing their effectiveness, accessibility, and inclusivity in diverse urban contexts.

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