

# **A Comparative Study Between Two Districts in Lima, Peru: A Case for Equitable Green Space Distribution**

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## **Abstract**

This study examines the disparities in green space access and quality between two districts in Lima, Peru: Santiago de Surco, characterized by organized urban planning and substantial green infrastructure, and Villa María del Triunfo, which faces challenges due to informal growth and limited public investment. Through a mixed-method approach—including spatial analysis, field observations, and resident interviews—the research identifies critical inequities in green area distribution, infrastructure quality, and safety. Findings reveal that while Surco benefits from well-maintained parks and equitable green space allocation, Villa María del Triunfo struggles with underutilized, poorly maintained parks and minimal recreational infrastructure, exacerbating social and environmental vulnerabilities. This study highlights the urgent need for inclusive urban policies that prioritize green space revitalization in underprivileged areas. Recommendations include enhancing existing parks with basic amenities and promote urban green spaces in low socioeconomic districts of Lima. The research contributes to advancing equitable urban development practices and underscores the role of green spaces in promoting environmental justice and well-being in rapidly urbanizing contexts.

**Key words:** urban parks, green space, urban planning, environmental justice, sustainable development

## INTRODUCTION

Globally, more than half of the population lives in urban areas, this trend will continue to grow and by 2050, the urban population is expected to increase by two-thirds (World Bank Group, 2023). However, this uncontrolled growth affects the social, economic and environmental structure, impacting the quality of life of its residents, especially those living in informal settlements (Breuste & Rahimi, 2015). What aggravates this situation are governments that allow development in these areas that do not have basic infrastructure, such as potable water or sanitation, increasing social and environmental disparities that affect human well-being (Fernandez et al., 2023).

A factor for improving the quality of life and well-being of their inhabitants is the presence of green areas in cities, since they mitigate the impact on health resulting from accelerated urbanization (Nguyen, Astell-Burt et al., 2021). The importance of urban green spaces lies not only in the benefits for the well-being of citizens, but also contributes to the sustainability and equity of cities, i.e., they are a key element in urban planning (Shan & He, 2024). Green areas provide environmental benefits, such as carbon sequestration, air purification, biodiversity maintenance, aquifer recharge and help regulate the climate, generating healthier and more balanced environments (Ayala-Azcárraga et al., 2019). Additionally, it is essential to ensure the safety of parks so that people can fully enjoy these spaces, benefiting the quality of life of residents. (Abdelhamid & Elfakharany, 2020).

In Peru, a large part of the population lives in coastal cities, especially Lima, whose surface area has multiplied by 42 and its population by 13 in the last 70 years (Delgado, 2020). This rapid growth highlights the importance of analyzing how urban planning and available resources affect access to green areas, especially in informal settlements. In these areas, generally located in the peripheries and with limited access to essential services such as water and sanitation, green infrastructure is often perceived as a luxury rather than a necessity, which aggravates social and environmental problems (Kamjou et al., 2024). Lack of proper planning and haphazard growth not only limit the development of new natural spaces, but also deteriorate existing ones, increasing the risks of pollution and urban heat islands. A study in Paris has shown that the scarcity of vegetation and the abundance of impervious surfaces increase mortality during heat waves (Pascal et al., 2021). This is a risk that also affects Lima and its most vulnerable sectors.

Access to green spaces is a key element of environmental justice, given their essential role in promoting health and equity (Hughey et al., 2016). Vulnerable communities face greater challenges due to the environmental burden they bear and their limited access to benefits such as urban green spaces, which jeopardizes their right to a healthy and equitable environment (Zhang et al., 2021). In urban settings, the unequal distribution of green spaces exacerbates existing disparities, highlighting the need to implement inclusive policies that foster environmental equity. Recent studies have shown that communities with lower incomes and higher concentrations of minorities often have less tree coverage, perpetuating socio-environmental inequalities and emphasizing the importance of planning strategies that address these disparities (Wang et al., 2024). This issue not only represents an environmental injustice but also a profound social inequity, as it restricts key opportunities such as recreation, social interaction, and connection with nature for certain population groups (Chen et al., 2020).

Despite a growing body of research highlighting the importance of green spaces in urban areas, there is a significant gap in the implementation of sustainable solutions within informal settlements. The growth of these communities puts considerable pressure on ecosystem services, especially affecting green spaces and surrounding natural environments (Hailu et al., 2024). Most research focuses on urbanized and consolidated areas, leaving out the most vulnerable communities, which could derive significant benefits from the incorporation of these spaces. In numerous contexts, informal settlements have contributed to 86.1% of the global loss of ecosystem services, highlighting the urgent need to implement specific measures (Hailu et al., 2024). This problem is particularly visible in Lima, where districts such as Villa María del Triunfo, with disorganized growth, suffer from a notable shortage of green spaces, in contrast to Santiago de Surco, which has managed to manage its urban development more efficiently.

While Surco has managed to invest its greatest resources in the creation of equitably distributed parks and recreational areas, benefiting its inhabitants with improved air quality, reduced heat stress and healthier living, Villa María del Triunfo faces serious problems stemming from a lack of urban planning. This situation negatively affects the well-being of its residents and increases environmental risks, which raises the urgent need to explore how to close this gap and encourage a fairer distribution of green spaces.

The objective of this study is to address this issue through a comparative analysis, focusing on urban planning strategies successfully implemented in Santiago de Surco and examining their potential adaptation for districts with fewer resources and high levels of informal urbanization, such as Villa Maria del Triunfo. Tools such as maps, analysis of local documents, field observations and community dialogues will be used to identify practical lessons that can contribute to reducing the lack of green spaces in areas of informal growth.

The research will focus on the following question:

How does socioeconomic development influence the quality and quantity of green areas in Lima's districts, specifically between districts with higher and lower public investment?

In addition, the social and environmental consequences associated with this lack will be analysed and specific solutions will be proposed to address them. This work seeks not only to improve the quality of life in informal settlements, but also to offer key recommendations for the design of more inclusive and sustainable urban policies capable of responding to the challenges of climate change and urban sprawl.

## **METHODOLOGY**

### **Study Sites**

This study focuses on two districts of Metropolitan Lima: Villa María del Triunfo and Santiago de Surco. They are chosen for their different socioeconomic development and their varied access to green infrastructure.

Villa María del Triunfo is a peripheral district facing high levels of urban informality, low public investment, and a notable shortage of green spaces. According to the National Environmental Information System (SINIA) of the Ministry of Environment, the district has only 0.37 m<sup>2</sup> of green areas per inhabitant, far below the World Health Organization's recommended standard of 9 square meters per inhabitant (Raffo, 2022). In a context where Lima has a total deficit of 56 million square meters of green areas, Villa María del Triunfo is positioned as the district with the least green areas in the city, reflecting the challenges of urban planning and social exclusion in the metropolitan periphery. With a population of 437,992 inhabitants (INEI, 2020), the district faces significant pressure on the few existing green spaces, highlighting the need to analyze the relationship between socioeconomic characteristics and access to healthy environments. This is why Villa María del Triunfo constitutes a good site to study the relationship between socioeconomic characteristics and access to public green spaces.

On the other hand, Santiago de Surco is located in a more economically developed area and has a more organized urban planning. The district manages 7.8% of the green areas of Metropolitan Lima, the second largest managed green area after Pantanos de Villa in Chorrillos (Municipality of Lima, 2020). This reflects Surco's commitment to the creation and maintenance of sustainable spaces, which contribute significantly to the quality of life of its inhabitants. With an estimated population of 378,977 inhabitants and an average density of 12,270 inhabitants/km<sup>2</sup>, the district faces challenges associated with its urbanization, including a high floating population flow of more than two million people at peak hours, which underscores the importance of accessible green spaces for the community (Municipality of Santiago de Surco, 2023). In addition, thanks to its above-average administrative capacity and economic resources, Surco has prioritized environmental and urban sustainability strategies, strengthening green infrastructure through effective local policies (Municipality of Surco, 2023). These factors allow the

district to maintain a balance between its residential areas and recreational spaces, ensuring both environmental and social benefits for its inhabitants.

The comparative analysis of these two districts will allow us to understand how socioeconomic conditions influence the planning and distribution of green areas in Metropolitan Lima. This study will provide key data to foster fairer and more sustainable urban policies, especially in contexts of rapid growth and informal urbanization. The contrasts between these districts can illustrate similar dynamics in other regions of Peru and globally, providing insights on how to ensure more equitable access to public green spaces.

### **Study Design**

This study uses a mixed-method, comparative approach to examine the impact of socioeconomic factors on the quality and perception of urban parks in two distinct neighborhoods. Data collection was conducted through map and document review, field observations, and interviews in both districts. This comparative analysis provides an understanding of differences in access to and quality of green space, critical to addressing inequities in urban development.

### **Data collection and analysis**

This study relies on three methods of data collection: map and document review, observations, and interviews.

A review of maps and documents was carried out to gather information on land uses, number and location of parks, as well as socioeconomic data in each district. For this, tools such as Google Maps and official reports were used. The information collected was spatially analyzed and used to create maps specific to each district, highlighting data within a one-kilometer radius. One residential location in each district was randomly chosen to delimit this radius, as the focus of the study is public access to green areas. This allowed us to illustrate how the distribution of parks and green spaces varies according to the socioeconomic characteristics of each area and to identify possible inequalities in their access. This approach facilitated the evaluation of residents' proximity to parks within the established radius, considering aspects such as population density and urban connectivity.

The results serve as a basis for developing planning strategies that seek a more equitable distribution of green areas in the future.

In addition, field observations were conducted to assess in detail the conditions of selected parks (**Figure 1**). At each location, one park was chosen for observations. These were conducted only once at each location, with the author spending between 30 minutes and one hour per park. Selection criteria included: strategic location (parks located in areas of high population density were chosen to assess their accessibility and relevance to the majority of local residents); community importance (the selected parks are recognized in their respective communities and represent key public spaces that reflect the conditions and customary use of green spaces in each district); and contrasting characteristics (parks were chosen that demonstrate significant differences in the quality of green spaces, highlighting infrastructure and resource challenges in Villa Maria del Triunfo and planning and maintenance achievements in Santiago de Surco). The observations focused on evaluating aspects such as infrastructure, including paths, playgrounds, and furniture; maintenance, considering cleanliness, care of green areas, and repair of facilities; safety, analyzing lighting, surveillance, and hazard signs; and public use, observing visitor activities, number of users, and profiles of those who frequent the parks.



**Figure 1:** Selected parks in each district with a radius of one kilometer.

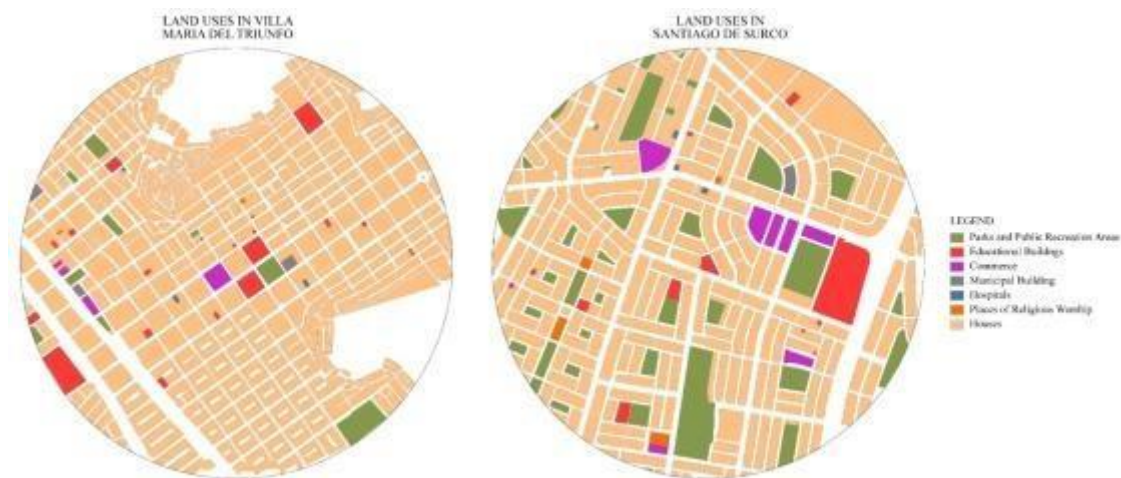
To complement the field observations and conclude this stage of the analysis, interviews were conducted with ten people, five from each district, to incorporate residents'

perspectives on the conditions and use of the identified parks. These interviews were conducted in the vicinity of the selected parks, and nearby residents were contacted randomly to solicit their participation. This process resulted in varied demographics: in Villa María del Triunfo, the majority of interviewees were older adults, while in Santiago de Surco, younger individuals predominated. Interview questions addressed key aspects of the parks, including the quality and condition of infrastructure, such as paths, playground equipment, and street furniture; perceptions of maintenance, focusing on cleanliness, care of green areas, and repairs; feelings of safety, considering lighting, surveillance, and personal experiences; and regular use of the park, covering activities performed, frequency of visits, and satisfaction with services. Responses were analyzed using the same thematic framework applied to the observational data, ensuring consistency and depth in understanding the challenges and opportunities associated with urban green spaces.



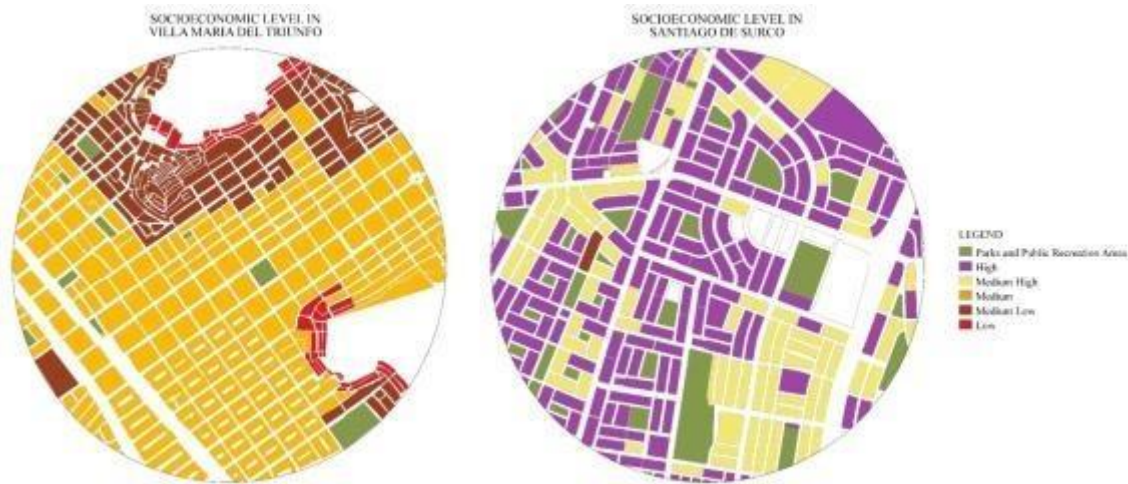
## RESULTS

The study of land use in Villa María del Triunfo and Santiago de Surco shows a clear difference in the allocation of space for services and infrastructure (**Figure 2**). In Villa María del Triunfo, residential areas occupy most of the territory, while spaces for parks, public recreation areas, educational institutions, stores and municipal services are limited and dispersed. In contrast, Santiago de Surco presents a more balanced distribution of land uses, with a greater amount of green areas and a prominent presence of educational, commercial and service buildings evenly distributed throughout its territory.



**Figure 2:** Land use comparison between the two neighborhoods.

The analysis of green areas in both districts (**Figure 3**) reveals a marked inequality in the quantity and accessibility of recreational spaces. In Villa María del Triunfo, parks are scarce and widely dispersed, limiting the opportunities for residents to enjoy outdoor recreational activities. On the other hand, Santiago de Surco has a more balanced and abundant distribution of green areas, which favors both accessibility and the creation of a healthier urban environment. **Figure 3** also compares the socioeconomic levels of the two districts. In Villa María del Triunfo, areas of low and lower-middle socioeconomic levels predominate, represented in red and brown, while areas of middle or high levels are rare. In contrast, Santiago de Surco has a higher concentration of upper-middle and high socioeconomic zones, identified in yellow and purple, along with significantly more green areas. These differences reflect greater investment in urban infrastructure and recreational spaces in Santiago de Surco, highlighting the connection between socioeconomic status and access to recreational spaces.



**Figure 3:** Green spaces and socioeconomic level comparison between the two neighborhoods.

Based on the results obtained on land use and socioeconomic level, **Table 1** presents a summary of the observations made in a representative park in a neighborhood in each district: Villa María del Triunfo and Santiago de Surco. The findings show marked differences in the quality and maintenance of these spaces. In Villa María del Triunfo, the park evaluated showed deficient conditions, with a low level of maintenance and insufficient equipment. In contrast, in Santiago de Surco, the park stands out for its good state of conservation, thanks to urban planning that prioritizes the proper care of green areas. This table offers a more detailed perspective on how factors such as socioeconomic status and infrastructure affect both the quality of life and the urban environment in each district, identifying possible areas for improvement to foster more equitable and sustainable urban development.

**Table 1:** Comparison of the conditions and use of the selected parks in Villa María del Triunfo and Santiago de Surco. Analysis based on observations made by the author.

Criteria		Park in Villa Maria del Triunfo	Park in Santiago de Surco
Infrastructure	Children's playgrounds	No	No
	Seating furniture	No	Yes
	Exercise furniture	No	Yes
Maintenance	State of vegetation	No green areas Trees with dry leaves	Well-maintained grass Variety of plants and trees
	Cleaning	Accumulation of garbage	Regular cleaning Garbage cans emptied frequently
	Pests	Presence of flies and cockroaches	No visible pests
Safety	Lighting	There are three streetlights throughout the park	Sufficient lighting
	Surveillance	Little presence of people to assist in surveillance	Security cameras, Regular patrols
	Dangerous elements	There are broken bottles, some wood and metal pieces thrown away	No
Park uses	Activities	No	Frequent use for walking, jogging, and outdoor activities, Playgrounds for children
	Frequency of use	Low	High
	User groups	No	Children, adults, seniors

To complement the visual analysis of the images and the observations made in the parks, interviews were conducted with pedestrians around the parks in each neighborhood.

These interviews allowed us to explore in greater depth issues such as infrastructure, safety, use and maintenance of the spaces. The responses reflected notable differences in the perception of the parks. In Villa María del Triunfo, participants highlighted that the absence of adequate furniture, the accumulation of waste, and safety problems limit park use, especially at night, when the area is often frequented by homeless people and risky activities. On the other hand, in Santiago de Surco, the perception was significantly more positive, with residents highlighting greater safety and more consistent use of the park, attributed to better maintenance and infrastructure conditions. **Table 2** summarizes the opinions collected, providing a basis for comparing the two contexts and showing how these factors influence the quality of life in each district.

**Table 2:** Comparison of citizen perception of parks in Villa Maria del Triunfo and Santiago de Surco. Analysis of interviews.

Criteria	Park in Villa Maria del Triunfo	Park in Santiago de Surco
General opinion	Neighbors consider the park unattractive and neglected, with no investment in infrastructure.	Residents highly value the park for its cleanliness, aesthetics, and good maintenance.
Infrastructure	There is no furniture of any kind, so there is no reason to use this park.	It is a park with modern playgrounds, exercise areas and areas for different recreational activities. There is almost always some activity or event.
Maintenance	Neighbors comment that maintenance is almost nonexistent, resulting in accumulated garbage and dry green areas.	Neighbors comment that maintenance is daily, there is regular cleaning and care of green areas.
Safety	It is perceived as unsafe, especially at night due to the lack of lighting and surveillance.	They feel safe when visiting the park thanks to the presence of surveillance and good lighting.
Park uses	They do not use the park because of the lack of security and recreational activities. One neighbor commented that it is not a place he would take his children.	It is a park where family, sports and community activities take place. Residents express a high level of satisfaction.

## **DISCUSSION**

The results of this research show that the distribution, access and quality of green spaces is not equitable, with the districts with the lowest socioeconomic level being the most affected. These inequalities limit the welfare opportunities of the residents of districts such as Villa Maria del Triunfo.

In the context of Lima, informal settlements such as San Cosme, Ciudad de Dios and Villa El Salvador evidence how unplanned urban expansion has aggravated the scarcity of green spaces (Martínez & Maroto, 2022). The prioritization of residential occupation over environmental planning has resulted in ecological degradation and the lack of recreational areas that promote the well-being of residents (Del Carmen et al., 2017). In addition, the disconnection of these settlements from consolidated urban centers limits the development of essential infrastructure, including the creation of green spaces. This situation reflects the fragility of state planning systems, underscoring the need for a holistic vision in urban design (Martínez & Ramos, 2022).

The average amount of green areas per inhabitant in Villa Maria del Triunfo is 0.37 m<sup>2</sup> (Raffo, 2022). In other words, this district has a deficit of green areas that affects recreational and environmental infrastructure. On the other hand, Santiago de Surco, presents a more favorable picture with respect to the percentage of green areas per inhabitant, in this case the district presents an approximate of 7.12%, this represents about 7.8% of the total area of the district dedicated to parks and recreational spaces (Municipality of Lima, 2020). The difference between the two districts not only demonstrates the inequality in the number of parks, but also better urban planning policies in Santiago de Surco. The presence of urban green areas have been shown to benefit the environment and human development by promoting mental and physical health, since they serve as recreational, touristic and cultural spaces (Cervantes-Nájera & Martínez-Rodríguez, 2023). In other words, Surco has improved the quality of life of its residents through its investment in parks and recreation areas, while Villa Maria del Triunfo has worsened living and environmental conditions.

Among the benefits of access to urban green areas, such as parks and gardens, is the possibility of physical activity, which contributes to improving people's health (Van Den Berg et al., 2015). Green spaces can prevent diseases such as cancer, diabetes, and

cardiovascular problems, which are related to factors such as air pollution and physical inactivity (United Nations, 2016.). Additionally, people who maintain contact with these areas have a greater capacity to deal with stress and other situations that affect their mental health (Guarda-Saavedra et al., 2022). Additionally, they are a key tool to mitigate the effects of climate change, since they promote carbon sequestration, reduction of air pollution, maintenance of biodiversity and climate regulation (Ayala-Azcárraga et al., 2019).

On the other hand, the safety of urban parks is a determining factor for their use and enjoyment. That is, the lack of lighting, poor maintenance and deterioration of the facilities dissuade users from making use of these spaces (Da Silva et al., 2024). For this reason, the park studied in Villa Maria del Triunfo is perceived as unsafe by its residents, especially at night, since the previously mentioned characteristics limit physical activity, socialization, and social cohesion. In contrast, the park located in Santiago de Surco demonstrates that investment in the care and maintenance of these spaces promotes use and maximizes their function as a recreational area and improves the quality of life of its residents. Ensuring the safety of parks influences people's overall well-being by promoting greater user use, which benefits the entire community (Abdelhamid & Elfakharany, 2020).

However, accelerated urbanization poses a significant challenge for the management of green areas, as the availability of land for the creation of new parks is limited. Therefore, it is proposed to improve the quality of existing areas (Del Carmen et al., 2017). Cases such as Al-Shalalat Park in Alexandria, demonstrated that there is an opportunity to improve the quality of life of the inhabitants by revitalizing these spaces (Abdelhamid & Elfakharany, 2020). Implementing low-maintenance vegetation, children's play areas, rest furniture and lighting would help to revitalize these spaces in districts with the characteristics of Villa Maria del Triunfo (**Figure 4**).



**Figure 4:** Proposal for improvement of the parks in Villa Maria del Triunfo (generated by AI).



## CONCLUSIONS

This study analyzed the socioeconomic disparities between two districts in Lima, Peru, to explore how economic development influences the use of public green spaces. The research relied on diverse data sources, including map and document analysis, direct observations, and interviews.

There is a clear disparity in both the quantity and quality of green spaces between Villa María del Triunfo and Santiago de Surco. While Surco benefits from effective urban planning and adequate resources for maintaining and expanding its green areas, Villa María del Triunfo faces serious challenges due to informal urbanization and limited public investment. Socioeconomic differences significantly impact the quality of public spaces. For instance, Surco's high human development index and greater financial capacity enable the implementation of advanced environmental policies. Conversely, Villa María del Triunfo exemplifies the negative effects of uncontrolled urban growth and resource scarcity. This contrast underscores the critical role of urban planning in fostering sustainable and equitable green spaces. The findings reveal how investing in green areas can enhance the quality of life in districts like Surco, while highlighting the urgent need for inclusive policies tailored to the specific challenges of Villa María del Triunfo.

Based on the findings, several recommendations are proposed to enhance green spaces in Villa María del Triunfo and improve urban planning moving forward. Firstly, the local government should focus on revitalizing existing parks by prioritizing maintenance, upgrading basic infrastructure such as seating, playgrounds, and pathways, and enhancing safety with better lighting and video surveillance systems. Such investments would not only encourage more frequent park usage but also mitigate security concerns, creating a healthier and more welcoming environment for residents. Additionally, it is vital to adopt environmental policies aimed at preserving and expanding green areas within the current urban framework. This approach would minimize costs while promoting a more equitable distribution of green spaces.

Future research could include longitudinal studies to assess the long-term effects of these improvements on residents' health and well-being. Another valuable avenue would be to explore participatory methods where residents of Villa María del Triunfo are actively

involved in the design and upkeep of green spaces, fostering a stronger sense of community. Furthermore, expanding the study to other districts in Lima with similar socioeconomic contexts could provide deeper insights into the dynamics of green space accessibility and inform metropolitan-level recommendations.

### **Limitations**

This study recognizes some limitations. Firstly, the interviews included only ten participants, divided equally between the two districts. This small sample may not adequately reflect the wide range of resident perspectives and experiences, restricting the depth of conclusions about park usage and perceptions. Secondly, park observations were conducted only once and for a limited duration of 30 minutes to one hour. Such a brief observation period may not capture variations in park use at different times of the day or across different days of the week, potentially influencing the evaluation of accessibility, safety, and maintenance.

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