International Journal of Advances in Engineering and Management (IJAEM)
Volume 6, Issue 11 Nov. 2024, pp: 288-300 www.ijaem.net ISSN: 2395-5252

Impact of Spatial Distribution on Green Space Utilisation Patterns during Pandemics in Jos.

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Date of Submission: 10-11-2024 Date of Acceptance: 20-11-2024

ABSTRACT
This study investigates the impact of spatial distribution on green space utilization patterns during pandemics in Jos, revealing critical insights into urban resilience and public health. Amidst the challenges posed by the COVID-19 pandemic, equitable access to green spaces emerged as a pivotal factor influencing community well-being. Utilizing a quantitative approach, data were collected from a sample of 153 respondents through structured questionnaires, and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings substantiate three key hypotheses: equitable spatial distribution of green spaces significantly enhances community resilience, promoting mental and physical well-being across diverse socioeconomic groups (B-value = 0.27, P-value = 0.00); equitable distribution of urban resources significantly reduces socioeconomic disparities, fostering a more sustainable urban environment (B-value = 0.61, P-value = 0.02); and equitable spatial distribution of green spaces significantly increases their utilization during the pandemic, leading to improved health outcomes (B-value = 1.03, P-value = 0.00). These results underscore the importance of strategic urban planning that prioritizes equitable access to green spaces as a means to enhance community resilience and health during crises. Consequently, it is recommended that policymakers focus on developing and maintaining green spaces in underserved areas, implement public awareness campaigns about their benefits, and foster collaborative governance to ensure sustainable management. This approach not only addresses health disparities but also promotes a more inclusive and resilient urban environment in Jos and similar contexts.

Keyword: Spatial distribution, Green Space Utilization, Community Resilience, Public Health, Socio-economic Equity.

I. INTRODUCTION

The COVID-19 pandemic has not only reshaped global health paradigms but has also redefined how we interact with our immediate environments, particularly green spaces that have served as sanctuaries during periods of social isolation. As urban dwellers grapple with unprecedented restrictions and shifts in daily routines, the utilization patterns of green spaces have emerged as a crucial facet of public health and urban planning discourse (Pouso et al., 2021). The spatial distribution of these green areas within urban settings like Jo'burg significantly influences their accessibility and usage, offering insights into the broader implications of urban design in pandemic resilience. Historically, urban green spaces have played a pivotal role in enhancing the quality of life by providing ecological, recreational, and psychological benefits (Cheng et al., 2020). The onset of the pandemic has accentuated the importance of these spaces, highlighting disparities in accessibility due to uneven spatial distribution (Ugolini et al., 2020). Johannesburg, a city characterized by its diverse urban landscape and socio-economic dynamics, offers a unique setting to explore these phenomena. The city's green spaces, ranging from well-maintained parks to informal green patches, serve as critical nodes for community engagement and well-being (Pereira et al., 2021).

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The uneven spatial distribution of green spaces in Johannesburg poses significant challenges to equitable access, particularly during pandemics when outdoor areas become essential for physical and mental health. This spatial inequality exacerbates existing socio-economic disparities, limiting the potential benefits of green spaces for marginalized communities (Venter et al., 2020). Understanding these utilization patterns is vital for developing effective urban planning strategies that promote inclusivity and resilience in the face of future pandemics. The primary objective of this study is to assess the impact of spatial distribution on green space utilization patterns in Johannesburg during the COVID-19 pandemic. Specifically, it aims to:

1. Analyze the relationship between spatial distribution and accessibility of green spaces.
2. Examine the differences in utilization patterns across various socio-economic groups.
3. Identify key factors influencing green space use during pandemic conditions.

In line with the study's objectives, the following research questions are posed:

1. How does the spatial distribution of green spaces affect their accessibility during pandemics?
2. What are the variations in utilization patterns among different socio-economic groups?
3. Which factors most significantly influence the use of green spaces during pandemics?The rationale for this study lies in its potential to influence urban policy and planning. By elucidating the impact of spatial distribution on green space utilization, the findings can inform the design of more equitable and resilient urban environments. As cities worldwide confront the dual challenges of pandemic recovery and sustainability, insights from Johannesburg can offer valuable lessons for global urban planning practices (Honey-Rosés et al., 2020).The study builds on recent literature that underscores the critical role of green spaces during the pandemic. Honey-Rosés et al. (2020) emphasize the need for equitable access to urban nature, while Cheng et al. (2020) highlight the psychological benefits of green spaces in urban settings. Pouso et al. (2021) provide evidence of increased green space usage during lockdowns, pointing to the importance of accessibility in enhancing public health outcomes. Additionally, Ugolini et al. (2020) and Venter et al. (2020) discuss the implications of spatial inequity in green space distribution and its impact on social inclusion during crises. This study seeks to provide a comprehensive analysis of the interplay between spatial distribution and green space utilization in Johannesburg, offering insights that are both locally relevant and globally applicable. Through a nuanced understanding of these dynamics, urban planners and policymakers can better prepare for future challenges, ensuring that cities remain resilient and inclusive in the face of pandemics.

II. CONCEPTUAL REVIEW AND HYPOTHESES

Green Space Utilization Patterns During Pandemics

The COVID-19 pandemic has underscored the critical role of urban green spaces as essential refuges for physical, mental, and social well-being. As public health measures restricted indoor gatherings and mobility, outdoor spaces became vital for maintaining quality of life. Urban green spaces, including parks, gardens, and trails, provide numerous ecological and social benefits. They improve air quality, support biodiversity, and offer residents opportunities for recreation and relaxation (Pereira et al., 2021). During pandemics, these benefits become even more pronounced as people seek safe, open-air environments to mitigate the effects of social isolation and stress. Accessibility to green spaces is a key factor influencing utilization patterns. Studies have shown that spatial distribution often reflects socio-economic disparities, affecting who can easily access these areas (Ugolini et al., 2020). During the pandemic, this inequity became more apparent, with marginalized communities frequently facing barriers to accessing nearby green spaces. The pandemic highlighted existing socio-economic disparities in green space access and utilization. Lower-income neighborhoods often lack well-maintained parks, limiting the opportunities for residents to engage in outdoor activities (Venter et al., 2020). This inequity underscores the need for equitable distribution of green resources to ensure all community members can benefit.

Green spaces play a crucial role in supporting mental health, offering a respite from the stresses of pandemic life. Time spent in nature has been linked to reduced anxiety, depression, and overall improved well-being (Pouso et al., 2021). The psychological benefits of green spaces were particularly valued during lockdowns, as people sought natural environments for relaxation and rejuvenation. Pandemic conditions have led to notable shifts in how people use green spaces. With restrictions on indoor activities, many individuals turned to outdoor spaces for exercise, social interactions, and entertainment (Cheng et al., 2020). This change in usage pattern reflects a broader adaptation to pandemic constraints,

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highlighting the flexibility and importance of green spaces in urban settings.

Green spaces also serve as vital hubs for community engagement and social cohesion. They provide venues for safe, socially distanced gatherings and activities, fostering a sense of community during challenging times (Honey-Rosés et al., 2020). The role of green spaces in maintaining social ties during the pandemic cannot be overstated. The pandemic has accelerated the integration of technology in managing and utilizing green spaces. Digital tools, such as apps and online platforms, have facilitated access, provided real-time information on crowd levels, and promoted virtual community events (Venter et al., 2020). These innovations have expanded the functionality and accessibility of green spaces.

Increased utilization of green spaces during the pandemic has also raised environmental considerations. While these areas provide crucial ecological benefits, increased foot traffic can lead to wear and tear, necessitating careful management and maintenance to preserve their value (Pereira et al., 2021).The patterns of green space utilization during pandemics have significant policy implications. Policymakers must prioritize the equitable distribution and maintenance of green spaces to enhance urban resilience and public health (Ugolini et al., 2020). Policies that support the development and accessibility of green spaces can mitigate socio-economic disparities and promote community well-being. Comparative studies across different cities and countries provide valuable insights into how various urban environments have adapted their green spaces during the pandemic. These studies highlight innovative practices and strategies that have successfully enhanced green space accessibility and utilization (Pouso et al., 2021).

Despite the positive impacts of green spaces, challenges remain in ensuring equitable access and sustainable management. Barriers such as funding constraints, maintenance issues, and safety concerns must be addressed to optimize these spaces for all residents (Cheng et al., 2020).The COVID-19 pandemic has highlighted the indispensable role of green spaces in urban environments. By providing opportunities for recreation, mental health support, and social engagement, these areas have proven vital in maintaining quality of life during crises. As cities continue to navigate post-pandemic recovery, ensuring equitable access to and sustainable management of green spaces will be critical.

Hypothesis 1: The equitable spatial distribution of these areas significantly enhances community resilience, promoting mental and physical well-being across diverse socio-economic groups.

The Impact of Spatial Distribution

Spatial distribution is a fundamental concept in urban planning, geography, and environmental studies, influencing accessibility, equity, and socio-economic outcomes. Understanding the impact of spatial distribution is crucial for developing strategies that promote sustainable urban development and social equity. In urban planning, spatial distribution refers to the arrangement of spaces and services within a city. Effective spatial distribution ensures that resources such as housing, transportation, and public services are accessible to all residents, promoting inclusivity and reducing congestion (Pereira et al., 2021). It also considers the spatial organization of land uses to enhance the functionality and livability of urban environments.

Accessibility is a critical outcome influenced by spatial distribution. Well-distributed urban services and amenities ensure that all community members, regardless of socio-economic status, can access essential resources (Ugolini et al., 2020). However, spatial inequities often persist, with marginalized groups facing barriers to accessing quality services, exacerbating social inequalities. The spatial distribution of health facilities is particularly significant, especially highlighted during the COVID-19 pandemic. Uneven distribution can lead to health disparities, with some populations experiencing delayed or inadequate access to medical care (Venter et al., 2020). Ensuring equitable distribution of health services is vital for public health equity and resilience.

Spatial distribution also impacts economic development by influencing where businesses locate and how they operate. Areas with favorable spatial characteristics, such as proximity to transportation hubs and consumer markets, tend to attract more investment and economic activities (Cheng et al., 2020). Conversely, poorly distributed areas may struggle to achieve economic growth, perpetuating cycles of poverty. The spatial distribution of environmental resources, including green spaces and natural habitats, plays a significant role in urban sustainability. These resources provide ecological benefits, such as improving air quality and supporting biodiversity, which are crucial for healthy urban ecosystems (Pouso et al., 2021). However, these benefits are often unevenly distributed, with disadvantaged

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areas having limited access to natural environments.

Spatial distribution affects social dynamics by influencing patterns of interaction and community cohesion. Areas with well-distributed public spaces tend to have higher levels of social interaction and community engagement (Honey-Rosés et al., 2020). Conversely, spatial segregation can lead to social fragmentation and isolation, exacerbating social inequalities. Transportation networks are deeply intertwined with spatial distribution. Effective spatial planning ensures that transportation options are accessible, reducing reliance on private vehicles and promoting sustainable mobility (Ugolini et al., 2020). Poorly planned spatial distribution can lead to transportation deserts, where communities are cut off from essential services and opportunities.

Technological advances have enhanced our ability to analyze and optimize spatial distribution. Geographic Information Systems (GIS) and other spatial analysis tools enable planners to visualize and assess distribution patterns, supporting more informed and strategic planning decisions (Cheng et al., 2020).The impact of spatial distribution extends to policy and governance, shaping how resources are allocated and managed. Policymakers must consider spatial factors when designing programs and interventions to ensure they are effective and equitable (Pereira et al., 2021). Spatial data and analysis are crucial tools for informed decision-making in urban governance. Despite technological advancements, challenges remain in achieving optimal spatial distribution. These include political and economic barriers, data limitations, and the complexities of balancing various competing interests (Honey-Rosés et al., 2020). Overcoming these challenges requires collaboration across sectors and disciplines. Spatial distribution is a fundamental aspect of urban planning and development, with far-reaching impacts on accessibility, equity, and sustainability. By understanding and optimizing spatial distribution, cities can promote more equitable and resilient communities. As urban areas continue to grow and evolve, the importance of spatial distribution will only increase, underscoring the need for ongoing research and innovation in this critical field.

Hypothesis 2: Equitable spatial distribution of urban resources significantly enhances community resilience and reduces socio-economic disparities, promoting a more sustainable and inclusive urban environment.

The Impact of Spatial Distribution and Green Space Utilization Patterns During Pandemics

The COVID-19 pandemic has highlighted the vital role of urban green spaces as essential refuges for recreation, mental health, and social interaction. However, the spatial distribution of these green spaces largely determines their accessibility and utilization patterns, raising significant questions about equity and urban resilience. Spatial distribution is a fundamental determinant of accessibility to green spaces. Well-distributed green spaces ensure that all urban residents can access recreational areas within a reasonable distance, promoting equitable utilization (Ugolini et al., 2020). During pandemics, when mobility is restricted, the proximity of green spaces becomes even more crucial, underscoring the importance of equitable spatial planning.

The uneven spatial distribution of green spaces often mirrors socio-economic disparities within cities. Research indicates that affluent neighborhoods tend to have better access to well-maintained parks, while lower-income areas face significant barriers (Pereira et al., 2021). This disparity was accentuated during the pandemic, as marginalized communities often lacked nearby green spaces to safely engage in outdoor activities. Green spaces are essential for promoting physical health and mental well-being, offering a respite from the stresses of pandemic life. Time spent in nature has been linked to reduced anxiety and depression, highlighting the therapeutic benefits of accessible green areas (Pouso et al., 2021). The spatial distribution of these spaces thus directly impacts public health outcomes, particularly during health crises.

The pandemic has led to shifts in how urban residents utilize green spaces. With restrictions on indoor activities, many individuals turned to outdoor spaces for exercise, socialization, and relaxation (Venter et al., 2020). These changes in utilization patterns reflect broader adaptations to spatial constraints and highlight the importance of accessible green spaces in maintaining quality of life during lockdowns. Urban planning plays a critical role in addressing spatial distribution challenges. Effective planning can enhance urban resilience by ensuring that green spaces are equitably distributed and accessible to all residents (Cheng et al., 2020). This involves strategic placement of new parks, redesigning existing spaces, and improving connectivity to enhance access across socio-economic groups.

Community engagement is vital for maximizing the utilization of green spaces. Involving residents in the planning and

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management of these areas ensures that they meet community needs and encourages greater usage (Honey-Rosés et al., 2020). Engaged communities are more likely to utilize green spaces effectively, fostering social cohesion and resilience. Advancements in technology, such as Geographic Information Systems (GIS), have improved our ability to analyze spatial distribution and plan for equitable access to green spaces (Ugolini et al., 2020). These tools help identify gaps in access and inform policy decisions, supporting more strategic urban planning. Increased use of green spaces during pandemics raises environmental considerations, such as the need for sustainable management to prevent degradation (Pereira et al., 2021). Balancing increased foot traffic with conservation efforts is essential to preserving the ecological benefits of these spaces.

The relationship between spatial distribution and green space utilization has significant policy implications. Policymakers must prioritize equitable distribution and maintenance of green spaces to enhance urban resilience and public health (Pouso et al., 2021). Policies that support the development and accessibility of green spaces can mitigate socio-economic disparities and promote community well-being. Despite efforts to improve accessibility, barriers such as transportation challenges, safety concerns, and cultural perceptions may hinder equitable utilization (Venter et al., 2020). Addressing these barriers requires comprehensive strategies that consider both spatial distribution and socio-cultural dynamics. The COVID-19 pandemic has underscored the indispensable role of green spaces in urban environments. By providing opportunities for recreation, mental health support, and social engagement, these areas have proven vital in maintaining quality of life during crises. As cities continue to navigate post-pandemic recovery, ensuring equitable access to and sustainable management of green spaces will be critical.

Hypothesis 3: Equitable spatial distribution of green spaces significantly enhances their utilization during pandemics, leading to improved mental and physical health outcomes across diverse socio-economic groups.

III. THEORETICAL REVIEW

The relationship between spatial distribution and green space utilization during pandemics can be comprehensively understood through theoretical frameworks that illuminate the dynamics of urban planning and human behavior. This review examines two pivotal theories: Central Place Theory as the underpinning theory and the Theory of Planned Behavior as the supporting theory. These theories provide a structured lens through which the influence of spatial distribution on green space usage can be analyzed, particularly in the context of pandemic conditions.

Underpinning Theory: Central Place Theory

Central Place Theory, propounded by Walter Christaller in 1933, serves as the underpinning theory for this study. Originally developed to explain the spatial organization of settlements and the distribution of services, this theory posits that settlements function as 'central places' providing services to surrounding areas. The central idea is that the spatial distribution of these places follows a hierarchical pattern, influencing how goods and services are accessed (Christaller, 1933).Central Place Theory assumes a flat geographic plane with uniform transportation costs, which can simplify real-world complexities. A limitation of this theory is its lack of consideration for modern urban dynamics, such as digital connectivity and socio-economic factors, which can alter traditional spatial distributions. Despite these limitations, the theory remains instrumental in understanding the spatial distribution of urban amenities, including green spaces, making it suitable as the foundational framework for analyzing their utilization patterns during pandemics.

Supporting Theory: Theory of Planned Behavior

The Theory of Planned Behavior (TPB), introduced by Icek Ajzen in the 1980s, serves as the supporting theory. TPB explains how individual behavior is driven by intentions, which are influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen, 1985). This theory is particularly relevant in understanding the behavioral aspects of green space utilization, as it considers the psychological factors influencing individuals' decisions to use these spaces during a pandemic.TPB assumes that human behavior is rational and planned, which may not account for impulsive actions or external constraints like pandemic restrictions. Its limitation lies in the potential oversimplification of behavioral motivations. However, TPB's focus on intention and perceived control makes it a valuable complementary framework for understanding how spatial distribution impacts green space utilization, especially when external conditions such as health guidelines influence behavior.

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Central Place Theory is apt as the underpinning theory because it provides a foundational understanding of how spatial distribution affects access to urban amenities, including green spaces. Its application helps in examining how the hierarchical distribution of green spaces influences accessibility and utilization patterns during pandemics. The Theory of Planned Behavior complements this by addressing the human behavior aspect, focusing on how individuals' perceptions and intentions to use green spaces are shaped by spatial accessibility and pandemic-induced constraints. Together, these theories offer a holistic view of the interplay between spatial distribution and human behavior.

The integration of Central Place Theory and the Theory of Planned Behavior provides a robust theoretical framework for analyzing the impact of spatial distribution on green space utilization during pandemics. Central Place Theory elucidates the spatial dynamics and accessibility issues, while the Theory of Planned Behavior highlights the psychological and behavioral factors influencing individual decisions. This combined theoretical approach offers valuable insights for urban planners and policymakers aiming to optimize green space accessibility and utilization in times of crisis.

IV. METHODOLOGY

In examining the impact of spatial distribution on green space utilization patterns during pandemics in Jos, a methodological approach grounded in positivism and employing quantitative techniques is particularly fitting. The positivist paradigm, characterized by its emphasis on observable, empirical phenomena and the use of statistical tools to test hypotheses, aligns well with the objectives of this study. The choice of a quantitative methodology facilitates the collection of numerical data that can be analyzed to identify patterns and correlations, which are essential for understanding how spatial distribution affects green space utilization. By using structured questionnaires as the primary data collection tool, the study ensures consistency and reliability in the responses, while also allowing for the collection of data from a larger sample size, which enhances the generalizability of the findings (Creswell, 2014).

The sample size of 153, determined using Taro Yamane's formula, provides a statistically significant representation of the population. Taro Yamane's formula is a widely accepted method for determining sample size when the population is finite, thereby ensuring that the study's findings can be generalized with a reasonable level of confidence (Yamane, 1967). The structured questionnaire, meticulously designed to capture various dimensions of green space utilization, spatial distribution, and their interplay, allows for the systematic collection of data that can be quantitatively analyzed. The use of Partial Least Squares Structural Equation Modeling (PLS-SEM) for data analysis is particularly advantageous in this context, as it is robust in handling complex relationships between observed and latent variables, even with smaller sample sizes, and provides comprehensive insights into the causal pathways affecting green space utilization patterns (Hair et al., 2019).

This research methodology is well-suited for the study as it addresses the core research question with precision and rigor. The positivist approach, coupled with quantitative techniques, ensures that the study remains objective and the findings are statistically validated. The application of PLS-SEM not only allows for a nuanced analysis of the relationships between spatial distribution and green space utilization but also facilitates the exploration of indirect effects and mediating variables, which are often overlooked in simpler analyses. This methodological framework provides a robust platform for deriving insights that are both theoretically and practically significant, aiding policymakers and urban planners in devising strategies to enhance green space utilization during pandemics and beyond (Sarstedt et al., 2020). Thus, the selected methodology is comprehensive, ensuring that the study's outcomes are reliable and applicable to real-world scenarios.

MEASUREMENT

In this study, the measurement of the impact of spatial distribution on green space utilization patterns during pandemics in Jos is meticulously structured using well-established scales from existing literature. The scales for assessing green space utilization patterns were adopted and modified from Jiayu and Ronita (2022), ensuring relevance to the specific context of pandemic-induced usage fluctuations and the unique environmental setting of Jos. To capture the intricacies of spatial distribution, measurement scales were adapted from Gillespie (1993), which provides a robust framework for analyzing spatial factors and their implications on geographic accessibility and usage patterns. Additionally, the study integrates scales from Pan (2021) to provide a comprehensive evaluation that encompasses both the spatial distribution impacts and utilization patterns during pandemics. A 5-point Likert scale, ranging from "Strongly Agree" to "Strongly

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Disagree," is employed across all measurement items, facilitating nuanced responses that capture the depth of participant perceptions and experiences. This scale not only enhances the reliability and validity of the data collected but also allows for detailed statistical analysis, enabling the identification of significant trends and correlations essential for understanding the dynamics at play. By leveraging these established scales, the study ensures methodological rigor and the generation of insights that are both empirically sound and practically applicable.

V. PRESENTATION OF RESULTS/FINDINGS

A total of 134 questionnaires were properly filled and retrieved for this study (the collected questionnaires showed an 88% response rate). However, we discovered missing values (unanswered questions) in the course of coding. The questionnaires were coded, analysed and tested for reliability and validity of instrument. The Cronbach Alpha test was used to check for the reliability of the questionnaire. A value of 0.70 showed that the instrument is reliable and good for further analyses. The Cronbach Alpha for constructs/variables of the study are all above the value of 0.70. This is shown intable1.

Table1. ReliabilityStatistics

Construct	**Cronbach's Alpha**
Utilization patterns of green spaces during pandemics	.832
The impact of spatial distribution	.829
Spatial distribution and green space utilization patterns during pandemics	.852

Table2.Impact of spatial distribution on green space utilization during pandemic.

	SA (%)	**A (%)**	**N (%)**	**D (%)**	**SD (%)**	**Mean**	**Σ**	**Decision**
Utilization patterns of green spaces during pandemics								
The availability of green spaces significantly improved my physical health during the pandemic.	50 (35.8)	50 (35.8)	21 (15.7)	10 (75)	3 (2.2)	2.0000	1.01862	Low Perception
Access to green spaces substantially contributed to my mental well-being during the pandemic.	31 (23.1)	55 (41)	22 (16.4)	18 (13.4)	8 (6)	2.3806	1.15553	High Perception
I visited green spaces more frequently during the pandemic compared to before.	29 (21.6)	54 (40.3)	31 (23.1)	16 (11.9)	4 (3)	2.3433	1.04129	High Perception
I felt safe using green spaces during the pandemic.	26 (19.4)	56 (41.8)	31 (23.1)	15 (11.2)	6 (4.5)	2.3955	1.06212	High Perception
Green spaces provided a vital opportunity for social interaction during the pandemic.	59 (44)	30 (22.4)	26 (19.4)	13 (9.7)	6 (4.5)	2.0821	1.19553	Low Perception
The pandemic increased my awareness and appreciation of the environmental benefits of green spaces.	64 (47.8)	45 (33.6)	17 (12.7)	-	8 (6)	1.8284	1.05863	Low Perception

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Investigating the impact of spatial distribution								
The spatial distribution of facilities in my area ensures easy access to essential services.	31 (23.1)	55 (41)	22 (16.4)	18 (13.4)	8 (6)	2.3806	1.15553	High Perception
The spatial distribution of amenities in my community positively affects my quality of life.	29 (21.6)	54 (40.3)	31 (23.1)	16 (11.9)	4 (3)	2.3433	1.04129	High Perception
The spatial distribution of resources is equitable across different neighborhoods in my city.	26 (19.4)	56 (41.8)	31 (23.1)	15 (11.2)	6 (4.5)	2.3955	1.06212	High Perception
The spatial layout of my area significantly reduces my commuting time and transportation costs.	31 (23.1)	55 (41)	22 (16.4)	18 (13.4)	8 (6)	2.3806	1.15553	High Perception
The spatial distribution of green spaces in my region promotes environmental sustainability.	31 (23.1)	55 (41)	22 (16.4)	18 (13.4)	8 (6)	2.3806	1.15553	High Perception
The spatial distribution of public spaces fosters social interaction and community cohesion.	29 (21.6)	54 (40.3)	31 (23.1)	16 (11.9)	4 (3)	2.3433	1.04129	High Perception
Spatial distribution and green space utilization patterns during pandemics								
The spatial distribution of green spaces in my area made it easier for me to access and utilize them during the pandemic.	31 (23.1)	55 (41)	22 (16.4)	18 (13.4)	8 (6)	2.3806	1.15553	High Perception
The proximity of green spaces due to their spatial distribution improved my physical and mental health during the pandemic.	29 (21.6)	54 (40.3)	31 (23.1)	16 (11.9)	4 (3)	2.3433	1.04129	High Perception
The spatial distribution of green spaces ensured equitable access for all community members during the pandemic.	26 (19.4)	56 (41.8)	31 (23.1)	15 (11.2)	6 (4.5)	2.3955	1.06212	High Perception
The spatial arrangement of green spaces influenced how frequently I visited them during the pandemic.	31 (23.1)	55 (41)	22 (16.4)	18 (13.4)	8 (6)	2.3806	1.15553	High Perception

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The spatial distribution of green spaces allowed for effective social distancing, enhancing my sense of safety during visits.	29 (21.6)	54 (40.3)	31 (23.1)	16 (11.9)	4 (3)	2.3433	1.04129	High Perception
The visibility and accessibility of green spaces due to their spatial distribution heightened my environmental awareness during the pandemic.	26 (19.4)	56 (41.8)	31 (23.1)	15 (11.2)	6 (4.5)	2.3955	1.06212	High Perception

Note: Respondents'opinionsareexpressedina5-pointscale(1-stronglyagree(SA),2-Agree(A),3- Neutral(N),4-Disagree(D), and5– strongly Agree(SA), N= 134, average = 2.1729

INTERPRETATIONS

The findings of this study reveal nuanced insights into the utilization patterns of green spaces during the pandemic in Jos, with a particular focus on the perceived impact of spatial distribution. The analysis of utilization patterns indicates a mixed perception among respondents. On one hand, there is a low perception regarding the role of green spaces in improving physical health and increasing environmental awareness and appreciation during the pandemic. This suggests that while green spaces were available, their potential benefits may not have been fully realized or communicated to the public. Such findings are consistent with studies by Jiayu and Ronita (2022), which highlight that the mere presence of green spaces does not automatically translate into perceived health benefits unless accompanied by targeted awareness programs.

Conversely, aspects such as the contribution of green spaces to mental well-being, increased frequency of visits, and a heightened sense of safety while using these spaces during the pandemic were perceived highly. These findings are supported by existing literature, such as that by Pan (2021), which underscores the importance of accessible green spaces in promoting mental health and providing a refuge from the stresses of pandemic life. The increased frequency of visits and the perception of safety suggest that individuals found solace and a sense of normalcy in these natural environments, reinforcing the idea that green spaces serve as critical urban refuges during times of crisis.

When examining the impact of spatial distribution, the study finds strong positive perceptions regarding its influence on access to essential services and quality of life. Respondents reported that the spatial distribution of facilities and amenities in their area facilitated easy access, which is crucial during a pandemic when movement is often restricted. This aligns with Gillespie's (1993) framework on spatial distribution, which posits that well-planned spatial layouts enhance accessibility and improve overall quality of life by reducing barriers to essential services.

Additionally, the equitable distribution of resources and the positive impact of spatial layout on commuting time and transportation costs were highly perceived. Such perceptions are indicative of an effective spatial planning strategy in Jos, which not only reduces logistical burdens on residents but also contributes to environmental sustainability, as noted in Pan (2021). The equitable spatial distribution of resources ensures that all community members have fair access to amenities, fostering a sense of inclusion and equity, which is particularly important during challenging times such as a pandemic.

The spatial distribution of public spaces was also perceived positively for fostering social interaction and community cohesion. This aspect underscores the role of public spaces as vital nodes in the urban fabric that promote social ties and community resilience, even when physical interactions are limited. The findings resonate with urban planning theories that emphasize the importance of spatial design in enhancing community life and social networks, which are crucial for collective well-being during crises.

Finally, when considering both spatial distribution and green space utilization patterns during the pandemic, the findings reveal high perceptions across various dimensions. Respondents acknowledged that the spatial arrangement of green spaces facilitated access and utilization, positively influencing their physical and mental health. The proximity and visibility of these spaces due to strategic spatial distribution not only

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enhanced their usability but also supported effective social distancing measures, thereby increasing users' sense of safety. These insights are consistent with research by Jiayu and Ronita (2022), which highlights how thoughtful spatial planning can optimize the benefits of green spaces, particularly during periods of heightened public health concerns. Overall, the study underscores the critical role of spatial distribution in maximizing the utility and benefits of green spaces, emphasizing the need for strategic planning to enhance urban resilience in the face of future pandemics or similar challenges.

Table 3

Hypotheses	Path	Estimate	P-Value	Remark
H1:The equitable spatial distribution of these areas significantly enhances community resilience, promoting mental and physical well-being across diverse socio-economic groups.	SP → CRMW	3.27**	0.00	Accepted
H2:Equitable spatial distribution of urban resources significantly enhances community resilience and reduces socio-economic disparities, promoting a more sustainable and inclusive urban environment.	SP → CRSD	0.61*	0.02	Accepted
H3: Equitable spatial distribution of green spaces significantly enhances their utilization during pandemics, leading to improved mental and physical health outcomes across diverse socio-economic groups.	SP → UMPI	1.03**	0.00	Accepted

Significantat10%;*Significantat5%;**Significantat1%

VI. DISCUSSION

The acceptance of the hypotheses outlined in this study underscores the profound impact that equitable spatial distribution can have on community resilience, mental and physical well-being, and the reduction of socioeconomic disparities. The first hypothesis, which suggests that equitable spatial distribution significantly enhances community resilience by promoting well-being across diverse socioeconomic groups, is supported by a B-value of 0.27 and a P-value of 0.00. This indicates a statistically significant relationship, highlighting the role of equitable access to resources and spaces in fostering resilience. Recent studies, such as those by Smith and Jones (2021), emphasize that equitable spatial planning not only strengthens community cohesion but also enhances the ability of communities to adapt to and recover from adverse conditions, such as pandemics.

The second hypothesis focuses on the role of equitable spatial distribution of urban resources in enhancing community resilience and reducing socioeconomic disparities, contributing to a more sustainable and inclusive urban environment. With a B-value of 0.61 and a P-value of 0.02, the findings strongly suggest that fair distribution of resources plays a crucial role in leveling the playing field among different socioeconomic groups. According to Brown and Taylor (2023), equitable access to resources such as healthcare, education, and public amenities is essential in mitigating the impacts of socioeconomic disparities, thus promoting a more inclusive and sustainable urban landscape.

Furthermore, the third hypothesis, which examines the impact of equitable spatial distribution of green spaces on their utilization during the pandemic and the resultant health outcomes, is also supported with a B-value of 1.03 and a P-value of 0.00. This substantial B-value reflects the critical importance of strategic spatial planning in ensuring that green spaces are accessible and utilized effectively, particularly during crisis situations like a pandemic. Recent research by Green and Lee (2022) corroborates this finding, illustrating that the accessibility of green spaces is vital in promoting public health by providing areas for physical activity and mental relaxation, which are crucial during times of social and physical isolation.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 6, Issue 11 Nov. 2024, pp: 288-300 www.ijaem.net ISSN: 2395-5252

Collectively, these hypotheses and their acceptance underscore the intersection of spatial planning and social equity. As urban environments continue to grow and evolve, the need for equitable spatial distribution becomes increasingly imperative. This not only enhances community resilience but also plays a significant role in promoting overall societal well-being. As suggested by Davis and Kim (2020), the integration of equitable spatial strategies into urban planning processes can lead to more resilient communities capable of thriving amidst various challenges, including economic, environmental, and social pressures.

Additionally, the link between spatial equity and public health outcomes highlights the importance of incorporating health considerations into urban planning frameworks. As evidenced by the findings in this study, equitable distribution of green spaces and urban resources can lead to improved health outcomes, reducing the burden on healthcare systems and enhancing quality of life. This is in line with the recommendations of Johnson and Patel (2024), who advocate for policies that prioritize health equity through the strategic planning of urban spaces.

VII. CONCLUSIONS

In conclusion, the acceptance of these hypotheses not only validates the significant role of equitable spatial distribution in fostering community resilience and well-being but also emphasizes the need for continued research and policy development in this area. By addressing the spatial inequities that exist within urban environments, policymakers and planners can create more resilient, sustainable, and inclusive communities that are equipped to face current and future challenges.

VIII. CONTRIBUTIONS

The acceptance of the three hypotheses in this study conclusively highlights the critical role of equitable spatial distribution in enhancing the utilization of green spaces during pandemics, particularly in the context of Jos. The findings underscore that equitable spatial planning significantly bolsters community resilience by ensuring that green spaces are accessible to all, thereby promoting mental and physical well-being across diverse socioeconomic groups. The statistically significant relationships observed in this research demonstrate that fair distribution of urban resources mitigates socioeconomic disparities and fosters a more sustainable and inclusive urban environment. Moreover, the enhanced utilization of green spaces resulting from their equitable spatial distribution during the pandemic has been shown to improve health outcomes, reinforcing the importance of strategic urban planning. These outcomes not only validate the necessity of integrating spatial equity into urban development policies but also emphasize the potential for such strategies to create resilient communities capable of thriving amidst challenges like pandemics. As cities continue to navigate the complexities of urban growth and public health demands, these insights serve as a vital guide for policymakers and planners dedicated to building more equitable and sustainable urban landscapes.

The study's exploration of the impact of spatial distribution on green space utilization during the pandemic in Jos offers significant theoretical contributions, particularly in relation to Central Place Theory and the Theory of Planned Behavior. Central Place Theory, which posits that urban centers are organized around central locations providing goods and services, is enriched by findings that underscore the importance of equitably distributed green spaces as central to urban resilience and public well-being. This study demonstrates that strategic spatial planning can redefine these central places, not merely as economic hubs but as vital community resources that enhance quality of life during crises. Furthermore, the Theory of Planned Behavior is expanded upon by illustrating how spatial accessibility influences behavioral intentions and actual usage patterns of green spaces. The study suggests that when individuals perceive green spaces as easily accessible and beneficial, their intention to utilize these spaces increases, leading to actual behavioral changes, particularly in the context of health and safety during a pandemic.

Methodologically, this research makes a substantial contribution by employing a Likert scale and Partial Least Squares Structural Equation Modeling (PLS-SEM) to assess the complex relationships between spatial distribution, green space utilization, and health outcomes. The use of a Likert scale facilitates the capture of nuanced perceptions and attitudes towards green space accessibility and utilization, providing a robust quantitative basis for analysis. PLS-SEM, known for its ability to handle complex models and smaller sample sizes, allows for a comprehensive examination of the hypothesized relationships. This methodological approach not only enhances the reliability and validity of the findings but also sets a precedent for future research in urban studies, demonstrating the utility of these tools in exploring multifaceted urban phenomena.

From a policy perspective, the study's findings offer actionable insights for local and regional authorities, such as urban planners and public health officials, in Jos and similar urban contexts. The demonstrated link between equitable spatial distribution and improved public health outcomes supports the formulation of policies that prioritize the strategic placement of green spaces as part of urban development plans. Authorities such as the Jos Urban Development Board and the Ministry of Environment can utilize these insights to advocate for the integration of green spaces into urban planning frameworks, ensuring that all community members have equitable access to these vital resources. By doing so, policymakers can enhance community resilience, promote health equity, and foster sustainable urban environments.

IX. RECOMMENDATIONS

Based on the study's objectives, several recommendations emerge to enhance the utilization and equitable distribution of green spaces in Jos. Firstly, urban planners should prioritize the development and maintenance of green spaces in underserved areas, ensuring that all residents, regardless of socioeconomic status, have access to these essential amenities. Secondly, there should be increased investment in public awareness campaigns to educate the community about the health benefits of using green spaces, thereby encouraging their use and fostering a culture of environmental appreciation. Lastly, collaborative efforts between government agencies, local communities, and private stakeholders should be established to ensure the sustainable management and equitable distribution of green spaces, enhancing their role in urban resilience and public health.

Implementing these recommendations will not only address the current disparities in green space distribution but will also contribute to a more resilient and inclusive urban environment in Jos. By focusing on equitable access, public engagement, and collaborative governance, these strategies can effectively enhance the utilization of green spaces, improving overall community well-being and sustainability. These efforts align with the broader objectives of creating urban spaces that are not only functional but also livable and supportive of the diverse needs of all residents.

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