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Modeling the Neighborhood Wellbeing of Townships in South Africa

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Abstract: Townships in South Africa are characterized by underdeveloped urban neighborhoods on the periphery of cities, where their inhabitants suffer from a poor quality of life. Given the relative lack of empirical research on the wellbeing of people living in townships in South Africa, this study attempts to fill the gap by understanding and modeling the relationships between household socioeconomic characteristics, housing and neighborhood conditions, and individual and community wellbeing to develop and empirically validate a neighborhood wellbeing framework. The hypothesized associations from the wellbeing framework were tested using 389 household interviews of the three largest townships in South Africa. The findings identify the challenges associated with adequate housing and lack of infrastructure in townships and how these affect the wellbeing of individuals and communities. The conclusion demonstrates how the neighborhood wellbeing framework, as an interdisciplinary approach, can improve the quality of life of inhabitants and communities in urban neighborhoods in general.

Keywords: housing; neighborhood; township; socioeconomic; wellbeing; South Africa; resilience

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1. Introduction

Enhancing the living conditions and quality of life of a broader South African populace in the national upper poverty line around townships remains a daunting task and a huge concern to both the state, civil society, and international organizations, as efforts to improve the wellbeing of cities and citizens are prioritized and emphasized [1]. South African townships are adjudged to be semi-permanent human settlements in the form of dormitory spaces for low-income earners, found in major South African metropolises. These townships are characterized by poor, inadequate, and substandard housing that offers no tenure of security for residents and inappropriate housing that is often non-compliant with building bylaws or planning regulations [2]. Occupants regularly experience indoor air pollution, overcrowding, and inadequate access to healthcare, basic services, and public amenities [3], combined with minimal access to utilities' infrastructure such as energy, water, education, and employment [4]. Urban density is partially attributed to these inappropriate spatial settings and insufficient property rights' adaptations [5]. The wellbeing of the township habitants of urban communities is usually exacerbated by their exponentially unplanned growth [6]. This is partly triggered by the migration from rural to urban areas for greener pastures [7]. The micro- and macroeconomic benefits of migration have already been covered in previous studies [7].

However, the wellbeing of residents and communities in these townships remains poor, as the lack of essential reliable urban infrastructures and adequate housing is weakened by rapid and unanticipated urbanization [2]. Consequently, as the population grows, the townships become more dense, giving rise to the need for more housing [2]. This has prompted the South African government to initiate various housing intervention programs,

but housing backlogs have continued to persist [8]. Furthermore, the World Health Organization's (WHO) integrated housing approach has extended housing concerns beyond the dwelling areas to also include the communities and neighborhoods as interconnected facets that contribute to health and wellbeing [9]. Thus, the wellbeing and health of housing occupants not only depend on the infrastructural enhancement and tenure security but also on the neighborhood environment and structural design attributes [10]. There is an interdisciplinary consensus that peoples' habitat broadly contributes to their overall health and wellbeing [11]; yet, the township inhabitants in South African cities are increasingly plagued by disproportionate economic and health burdens, exacerbated by poverty and vulnerability [12]. This reinforces the physical and mental health risks, further entrenched in the persistent disparity in health and socioeconomic opportunities [12]. The location and conditions of the townships' infrastructure and services alone are not sufficient to address wellbeing issues. The health and wellbeing of individuals are greatly influenced by the social, structural, spatial, and environmental makeup of the area [13].

Many scholars have alluded to the fact that the resilience of cities and urban neighborhoods is strongly linked to the health and wellbeing of citizens [14–16]. Various scholars have used different mathematical techniques to model wellbeing in neighborhoods. For instance, Zuniga-Teran et al. [17] used statistical analysis to model the neighborhood design and assess the level of walkability and its effects on physical activity and wellbeing of five neighborhoods in Arizona. Dong and Qin [18] used an advanced hierarchical multilevel model to analyze the association between neighborhood environment and residents' mental wellbeing in Beijing's neighborhoods. The study of Mouratidis [19] explored the links between neighborhood deprivation and neighborhood characteristics, neighborhood satisfaction, and wellbeing in Oslo, using pairwise correlations and linear regression. In another study, Cramm et al. [20] used multilevel regression analysis to quantify the effect of the social environment on the wellbeing of older adults to promote active aging in the neighborhoods in the Netherlands. However, in South Africa, studies that model the neighborhood wellbeing of townships are rare, and studies that link the household socioeconomic characteristics, housing features, and neighborhood features to the wellbeing of individuals in township communities are also very rare and sometimes ignore the local context and situations in Africa in general. The need therefore arises to enhance the understanding of these themes in terms of how dwellers' socioeconomic status affects their accessibility to basic urban infrastructure and services, with real consequences on security, physical and mental health, and wellbeing. The convergence of these ideas has thus become an essential part of the study and the methodology that underpins the current study. Within these elements, current studies have connected different urban neighborhood features to the effects on public health particularly in low-income neighborhoods and townships. Themes of health, infrastructural situation, socioeconomic truths, and food and water access have been investigated differently to assess their inter-linkages and determine possible areas for intervention. An interdisciplinary and participatory approach is thus required to comprehend their intricacies [21].

This paper thus scrutinizes the association between the household socioeconomic characteristics, housing conditions, and neighborhood conditions on the wellbeing of individuals (micro) and communities (macro) in South African townships, which are significantly disturbed by undeveloped highly dense urban conditions and the lack of adequate housing and infrastructure, to address the existing gap in body of knowledge. This is achieved through the following objectives:

1. Evaluate the current living conditions of South African townships through conducting structural household interviews.
2. Ascertain the importance and effect of various constructs and subconstructs on the wellbeing of individuals and communities using multivariate confirmatory factor analysis.
3. Determine the key constructs and subconstructs of wellbeing in South African townships to customize the neighborhood wellbeing framework as a standard tool for evaluating the township conditions and appropriate improvement solutions.

The paper is structured as follows: Section 2 consists of a literature review of wellbeing definitions, interrelations, intersectionality, attributes, and townships in South Africa; Section 3 presents the theoretical framework, the hypothesis, and the method of research; Section 4 offers the findings and the discussion of research thence validating the township wellbeing model; finally, Section 5 summarizes the conclusions and recommendations.

2. Literature Review

The design of urban neighborhoods in dense global south cities has become increasingly concerned with various dimensions of wellbeing. Scholarly studies that scrutinize the connection between spatial layouts of neighborhoods and wellbeing have particularly paid attention to physical and mental health and social wellbeing [10], but unfortunately, this is usually ignored in cases of townships. A study by Ramezani et al. [22] for instance, theorized the link between spatial layout, urban density, and built-environment patterns, where different city patterns such as compact city and cruciform city were identified in examining the associations between density, spatial layout, and urban infrastructures. Maintaining a spacious city in designing and planning should be a holistic venture that considers the townships as an integral part of a sustainable city, where regulatory policies observed by the built professionals are mandated to be incorporated in township construction, which should simultaneously aim at driving affordable housing and healthy communities [2]. Although no rudimentary planning and designing exists in such habitats due to their mixture of formal and informal nature, spatially containing communities is essential to avert extreme densities and provide healthy access to integrated spaces and social interaction [23]. Crammed, intensively connected, and dense environments of townships, which prevent human wellbeing, are inappropriate and inadequate to deliver benefits to the rest of the urban population [2].

Some other scholars have explored wellbeing and density through diverse topics. For instance, Alam and Ali [24] explored the different forms of wellbeing and health dangers that exist in an urban environment and their dynamic ever-changing nature and highlighted the spatial and socioeconomic dimensions in their study. A study by Ali et al. [25] considered the connection between vulnerability and the characteristics of an urban area, particularly the socioeconomic conditions of neighborhoods or townships, and how the historical, cultural, political, and economic factors have resulted in escalated vulnerability to disease within low-income neighborhoods in developing countries. Del Rio and Sovacool [26] investigated low-income neighborhood needs such as housing, energy, accessibility, and mobility, as well as challenges to the overall health, wellbeing, and quality of life, and recommended guidelines to achieve spatial justice in these neighborhoods. However, to have an in-depth understanding of the current study, the authors consider the following themes.

2.1. Wellbeing Definitions, Interrelations, and Intersectionality

Attention has been paid to wellbeing research using various indicators for its evaluation. The term wellbeing may be popular in the scientific debate, with diverse interpretations, but it does not have a standard definition at the conceptual level [27]. However, WHO defines wellbeing as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". This does not only apply to an individual's physical health but also embodies the diverse perceptions of the urban environment and the degree of compactness and crowdedness with the associated spatial experience [28]. Urbanization and industrialization are the key factors that aggravate population growth and increase the degree of congestion in cities, with challenging spatial formations such as townships. These spatial formations are weighed on different scales ranging from the house to the general neighborhood and form a crucial part of the definition of wellbeing. Moreover, the housing composition, the psychosocial home environment, and the attributes of the neighborhood and community (low income) have a significant impact on the physical, mental, and social wellbeing of low-income neighborhoods and communities [29].

Again, density and wellbeing are viewed from the prism of sustainability and resilience concepts. There are increasing discourses that cities offer exclusive opportunities to improve resilience to the negative occurrences in cities but also to attaining sustainable development [30]. So, sustainability conceptualizations generally require that humans do not compromise the needs of the future while addressing the needs of the present generation. The concept arose from the realization that there is a need to balance economic growth and social progress with environmental concerns [1]. The United Nations reports that 68% of the global population could be living in urban areas by 2050. Moreover, in 2015, Africa had the second highest population growth in the world, with about 200 million slum dwellers, which then aggravates the challenges of housing, infrastructure and basic services, and the growth of inadequate housing and neighborhoods [31]. Therefore ecological, social, and economic tri-domain sustainability concepts are the parameters adjudged in tackling inadequate human settlements' and townships' sustainability challenges.

The conceptualization of urban resilience [32] can be traced to C.S. Holling's momentous works defining resilience as "a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" [33]. In broader evolutionary terms, urban resilience is seen as "a proactive rather than reactive view to planning, policy-making and strategic steering in which communities play a vital role for resilient place shaping through their capacity for active learning, robustness, ability to innovate and adaptability to change" [34]. Resilience has been related to the institutional ability to minimize danger and threats and to adapt, impact, and regulate urban systems after a disruptive occurrence or a challenging event [35].

Studies have also signified how psychological aspects of resilience exist as safeguarding factors in minimizing the social, economic, and environmental challenges in neighborhoods [32]. It is broadly acknowledged to be the individual or collective capability to effectively cope with stress or change [36]. It is also associated as a competing concept when incorporating the social and cultural aspects of sustainability [37] or as a measurable indicator [38]. One of the significant aspects of psychological resilience in terms of wellbeing could be associated with family resilience, defined as a household's ability to resist and recover after stressful misfortunes or to even become stronger and more innovative, as the township dwellers appear to have adapted to similar stresses. This is manifested in a household's cohesion, communication, understanding the challenges, and being able to remain resilient in the face of adverse situations, by being resourceful and persistent [18,39].

Subsequently, resilience can be transformed into health and social wellbeing when faced with sudden disasters. Being able to resist and cope with adversities naturally strengthens one's mental and physical wellbeing in the townships. Zeng et al. [40] affirm that urban sustainability and resilience solicit the conservation of communal and societal health and wellbeing in the broader framework of environmental transformation. The United Nations Conference on housing and sustainable urban development (Habitat III) in Quito 2016, proposed the new urban agenda, representing the new shared vision of cities and settlements for all in their "right to the city". The sustainable integrated urban approach aims to achieve suitable and affordable housing as a key tool for achieving an adequate standard of living and wellbeing. The principles of the agenda are to promote access to physical, social infrastructure, and services to all human beings equally and to demolish all forms of poverty. The UN's eleventh goal aims to increase affordable housing and consider upgrading the slums and, in addition, to ensure that all people around the world have the right of access to affordable, adequate, safe housing and settlements.

In South Africa, a township is an area on the periphery of a town or city that has historically been used to uphold racially segregated living arrangements. The township system was originally put in place during apartheid, a political system that was in place from 1948 to the early 1990s. Living conditions in townships were typically poor and overcrowded. After apartheid ended, the townships in South Africa were desegregated and some have been improved to provide the development of greater wealth for their

occupants, including the development of a middle-income group. However, most of the South African townships still lack essential infrastructure, and many residents of townships live in poverty with poor wellbeing conditions [41].

Hence, township dwellers encounter both social and spatial marginalization and are exposed to mental, physical, and overall wellbeing risk [3]. The Sustainable Development Goals (SDGs) accentuated the importance of addressing this need particularly through the universal advocacy for adequate housing and sustainable habitats in SDG 11. This goal attempts to "make cities inclusive, safe, resilient and sustainable" via gaining access to safe, adequate and affordable housing for all. WHO's Housing and Health Guidelines [42] stress the impact that an existing habitat has in shaping and influencing one's health and wellbeing. SDG 3, on the other hand, promotes healthy living and wellbeing for everybody at all ages. The interplay between SDG 3 and SDG 11, which targets addressing the lack of habitable surroundings (SDG11), is crucial for achieving health and wellbeing for all (SDG3). Concerns on densities and the general deplorable environmental hygiene of townships are raised because they provide the work force for most cities in Sub-Saharan Africa generally. This by implication means that the higher the wellbeing associated risks, the higher the chances of infection and the transmission of infections in those settlements, which consequently poses risks for other parts of an urban precinct or the city as a whole [43].

2.2. Wellbeing Attributes

The latest study of the relationship between health and building conditions has recognized that the enhancement of air ventilation, water use, and refurbishment are affiliated with positive impacts on mental and physical health and consequently the quality of life of individuals and families [44]. However, it was difficult to verify the causal connections due to the lack of empirical data and methodological rigor in the studies employed for the review. This is the crux of the issue. The limited empirical evidence due to the complexity and constant flux of townships presents a fundamental challenge for researchers [45]. The need to address most of the deficits enumerated in this paper is stressed in the SDGs as synchronized expectations worldwide to attain sustainable development by 2030, in particular, via the provision of adequate livable healthy environments, which seek to create safe, inclusive, resilient, and sustainable cities. The risks of density in townships appear to be embodied in the tri-domain socioeconomic and environmental parameters of sustainability which affect the epidemiological aspects of the townships. The 'new normal' should involve adopting a more socioeconomic and environmentally responsive lifestyle for a better community. Sustainability, which promotes community resilience, in socioeconomic–environmental terms, should be the watchword in designing and planning for health. Therefore, the built environment should play that transformative role through innovative and creative thinking in planning and ensuring the environmentally responsive and friendly design of houses when the upgrading and restructuring of townships are allowed.

Many authors have agreed that a spatially incorporated development is meant to reduce urban integration and alleviate climate change [6,46]. This is almost impossible in townships as greenhouse gas emissions from crowded townships and informal settlement dwellings pollute the environment. The poor housing configurations are characterized by increased in-house gas emissions and environmental pollution. The inhabitants of these neighborhoods share some environmental risks that emanate from inadequate planning that lead to insufficient access to healthy sanitation and urban amenities [1]. This presents the perception of neighborhood effects, characterized by factors that impact health that are independent from household levels. These factors include geographic factors, social interactions, institutional factors, and the physical environment that people live in [47,48]. It is important to comprehend the complicated dynamic of the local context and conditions of the settlement's surroundings while evaluating wellbeing.

From a spatial planning lens, Shekhar et al. [49] agree that wellbeing can be viewed as a subjective (individual) term, while Atkinson et al. [50] assert it from a collective (community) dimension, comprising shared culture and economy. The implications, the

area for participation, access, and security are aspects to consider. Planning and policy practices have an impact on these aspects, and because of their interdependencies, a change in one element can either increase or decrease one's sense of total wellbeing [49]. These ideas served as the foundation for our research technique in this work, which involved quantifying the different characteristics that make up these intricate dimensions.

2.3. Township Situation in South Africa

South Africa is recognized as one of Africa's most urbanized countries (68% compared to 44% average urbanization rate of Africa), with overwhelming post-apartheid rapid urbanization transcending the state's capacity to provide adequate urban infrastructures and services. This has prompted the proliferation of formal and informal settlements in the townships with profound disparities and a warped urban landscape [4]. Apartheid spatial planning and the neglect of black urban residential areas remain evident in the planning system. These townships are often located at the urban periphery far away from the city's core and are characterized by penurious housing and infrastructural absence, intense poverty, and multiple health and social challenges.

Aside from the apartheid planning laws that encouraged racial segregation, the housing formation challenge is partly attributed to South Africa's planning and building laws commonly shared by all former British colonies in Africa inherited from Great Britain. The colonial regulations served partly to put in place a system of urban racial segregation between the colonizers and the colonized [51], and this was replicated in South African cities. This has largely impacted housing patterns in most South African cities. Although apartheid ended in 1994, it left a legacy of housing inequity, informality, and inadequacy throughout the country [52]. Apartheid laws restricted black South Africans in terms of property rights, justified the forcible relocation of thousands of black South Africans to the outskirts of the city, and left segregated neighborhoods. So, South Africa's planning was based on these racial lines, whose structure served as a plan for apartheid's spatial ideology, separating white and racially defined black communities [53].

There have been conscious attempts by the post-apartheid government to improve townships and housing brought about the introduction of township and housing policies, such as the Comprehensive Housing Plan and Breaking New Ground strategy, etc.; yet, little has been achieved to change the township situation in South Africa. The post-apartheid new constitution has defined the new South Africa to be deracialized and not limited to social and spatial potency for everyone [54]; however, the reality is different; a kind of "neo-apartheid has emerged, particularly in the socio-spatial distinction mechanisms and race-oriented seclusion procedures that are in place in the South Africa's urban areas" [54], even though the policies were within a framework of a paradigm shift towards a complete integrated social change in which townships were identified as "a manifestation of structural social change, the resolution of which requires a multi-sectoral partnership, long-term commitment and political endurance" with emphasis on economic development and sustainability [4]. However, the wellbeing challenges in townships still persist, and little has been achieved in addressing the problems. The problems identified in the case studies are similar in nature.

3. Material and Methods

There is a lack of research on the wellbeing of rapidly growing townships in South Africa and limited knowledge of the interrelationship between household socioeconomic characteristics, built environment features, and wellbeing. Therefore, the current research utilized a systems approach to investigate and model the interlinked constructs that influence the wellbeing of township residents and communities to address the existing gap.

According to the wellbeing framework, the household socioeconomic characteristics, housing features, and neighborhood features directly influence the wellbeing attributes. Moreover, the household socioeconomic characteristics and neighborhood features indirectly influence wellbeing through housing features, as depicted in Figure 1.

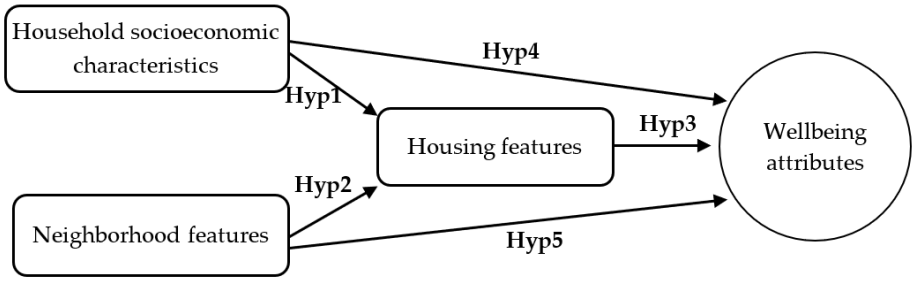

Figure 1. Wellbeing framework.

Therefore, the study tested the following hypotheses in the context of South African townships:

Hypothesis H1: *There is a significant association between the household socioeconomic characteristics and the housing features.*

Hypothesis H2: *There is a significant association between the neighborhood features and the housing features.*

Hypothesis H3: *There is a significant association between the housing features and the wellbeing attributes.*

Hypothesis H4: *There is a significant association between the household socioeconomic characteristics and the wellbeing attributes.*

Hypothesis H5: *There is a significant association between the neighborhood features and the wellbeing attributes.*

Method of Research

The research adopted a quantitative research design as the most appropriate approach to validate the developed theoretical framework model based on the WHO holistic approach to explore wellbeing and verify the relationships among the constructs. Structured household interviews were undertaken in the three largest South African townships to determine the household socioeconomic variables and included the head of household characteristics, the housing features, the neighborhood features, and wellbeing attributes in South African townships. The questionnaire interview comprised four sections directed at the study objectives. Section 1 obtained the socioeconomic characteristics of households in townships using 8 questions. Sections 2–4 contained 13, 10, and 7 questions, using five Likert scales to determine the availability or accessibility of housing, the neighborhood features, and the wellbeing attributes in the three townships (See Table 1). The study constructs and subconstructs used in measuring the wellbeing and its corresponding measurement scale are depicted in Table 1.

Table 1. Constructs and subconstructs of the study.

Constructs	Subconstructs	Code	Source	Measurement Scale
Household socioeconomic characteristics	Level of income	HH1	[1,2,4,26,29,41]	Open-ended
	House ownership	HH2	[1–4,18]	
	Size of family	HH3	[1,2,4,18]	
	Duration of living in the neighborhood	HH4	[1,7]	
	Age of head of household	HH5	[1,2,9,11,18]	
	Sex of head of household	HH6	[1,9,11,18]	
	Education of head of household	HH7	[1,11,18]	
	Job of head of household	HH8	[1,4,11,18]	
Housing features	Adequate natural light	H1	[1,12,39,44]	Respondents were asked to reveal the availability or accessibility of each variable and evaluate the importance of variables.
	Appropriate natural ventilation	H2	[1,12,14,39,44]	
	Connection to clean water	H3	[1,12,14,21,39,44]	
	Connection to electricity	H4	[1,2,12,14,39,44]	
	Connection to safe sanitation system	H5	[1,12,21,39,44]	
	Connection to stable internet connection	H6	[1,12,39,44]	
	Disaster resistant	H7	[1,12,14,25,39,44]	
	Has a private and safe bathroom	H8	[1,12,21,39,44]	
	Has a private and safe toilet	H9	[1,12,14,21,39,44]	
	Has a secure and safe open area	H10	[1,5,12,13,39,44]	
	Has a kitchen or separate cooking area	H11	[1,12,39,44]	
	Has enough space to accommodate the family	H12	[1,2,12,23,39,44]	
	Privacy in the house	H13	[1,2,12,39,44]	
Neighborhood features	Access to open communal/public spaces in the neighborhood	N1	[1,2,5,13,23]	
	Access to safe and incisive public transport	N2	[1,17,41]	
	Access to schools and childcare facilities in the neighborhood	N3	[1,2,54]	
	Access to shops and other commercial amenities in the neighborhood	N4	[1,2,54]	
	Access to healthcare facilities in the neighborhood	N5	[1,9,29]	
	Inclusivity (female-, youth-, elderly-, and disability-friendly environment)	N6	[1,9,28]	
	Protects community against disasters	N7	[1,25]	
	Safe and secure	N8	[1,2,18,20]	
	Supports the local business and economy	N9	[1,20]	
	Walkable	N10	[1,5,13]	
Wellbeing attributes	Living in a safe environment	W1	[1,2,5,13,17,18]	
	Being part of community	W2	[1,20]	
	Access to necessary help and support with care	W3	[1,9,18,20]	
	Socially sustainable	W4	[1,13,20]	
	Financially sustainable	W5	[1,2,4]	
	Emotionally/mentally healthy	W6	[1,9,12,18,20]	
	Physically healthy	W7	[1,9,12,18]	

The study population consisted of 17,000 formal households living in the three largest townships located in the periphery area of mega cities in South Africa, namely: Soweto township located at border of Johannesburg (Figure 2a), Khayelitsha located on the Cape Flats outside of Cape Town (Figure 2b), and Umlazi located southwest of Durban (Figure 2c). In total, 389 complete and valid household interviews were conducted as the sample size across these three townships, representing a sufficient sample size (383) at a confidence level of 95% and confidence interval of 5. The 389 households' information were scrutinized using various statistical techniques. Path analysis and exploratory factor analysis were used to evaluate the validity of the wellbeing framework constructs and subconstructs. Furthermore, Structural Equation Modeling (SEM), a comprehensive approach for modeling complex relationships between the observed and latent variables for confirmatory and exploratory purposes [55], was utilized in validating the association between the wellbeing constructs, based on the maximum likelihood estimate.

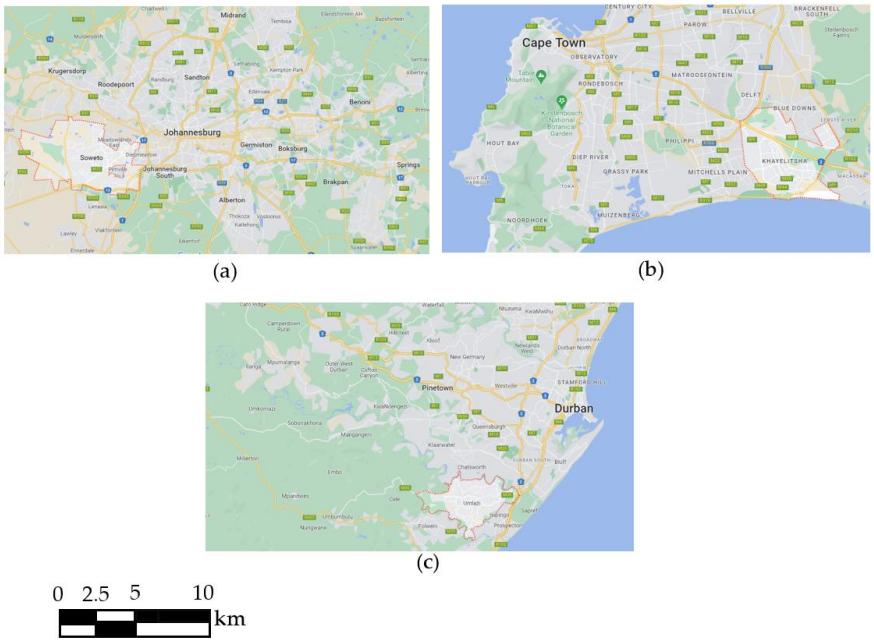

Figure 2. Townships map. (**a**) Soweto township, Johannesburg; (**b**) Khayelitsha township, Cape Town; (**c**) Umlazi township, Durban.

The research protocol of the study is summarized in Figure 3.

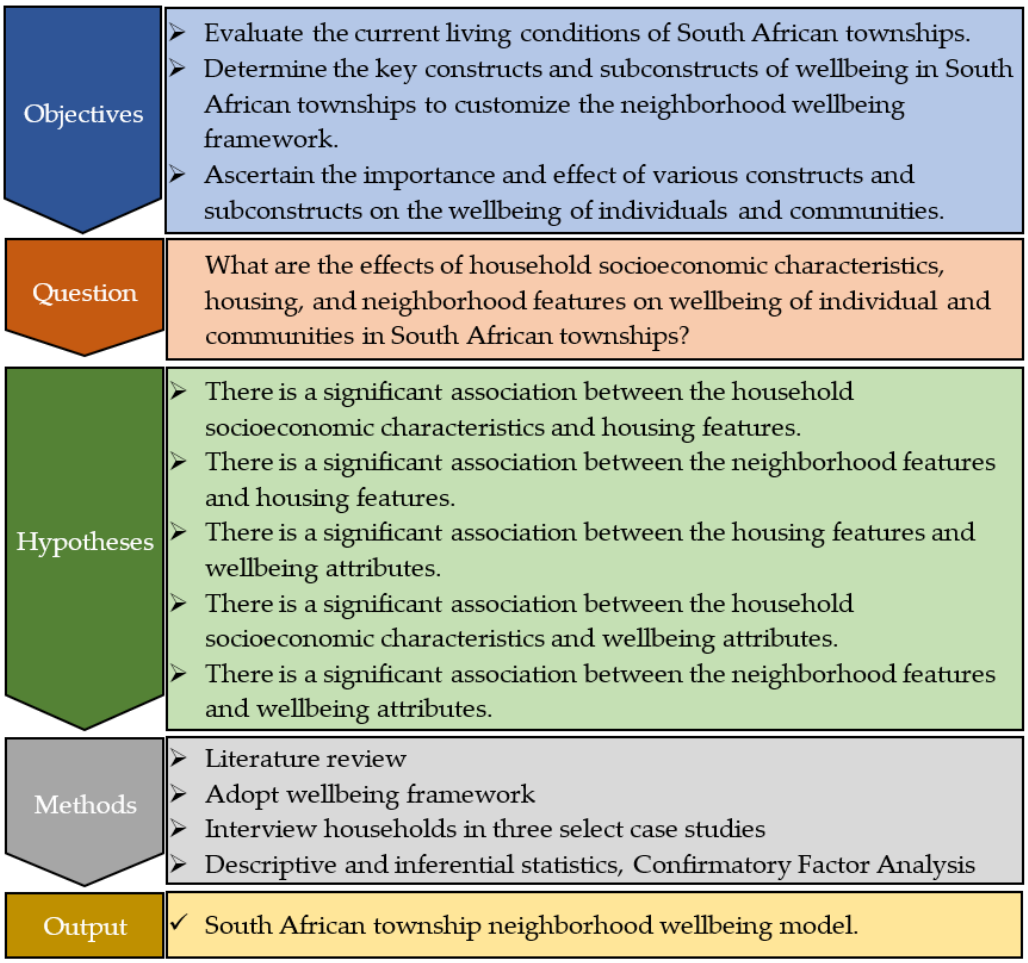

Figure 3. Research protocol of study.

4. Results and Discussion

4.1. Households' Socioeconomic Information

The demographic information of the head of households and socioeconomic information of 389 interviewed households are listed in Tables 2 and 3.

Table 2. Demographic information of the head of household.

Description	No. of Participants	Percentage	Cumulative %	Rank
Sex				
Male	185	47.6%	47.6%	2
Female	198	50.9%	98.5%	1
Others	6	1.5%	100%	3
Age				
18–30	153	39.3%	39.3%	1
31–45	118	30.3%	69.6%	2
45–60	85	21.9%	91.5%	3
Above 60	33	8.5%	100%	4
Education				
Never been to school	39	10.0%	10.0%	3
Primary school	47	12.1%	22.1%	2
High school/National diploma	287	73.8%	95.9%	1
University graduation	16	4.1%	100%	4

Table 2. *Cont.*

Description	No. of Participants	Percentage	Cumulative %	Rank
Job				
Employed (Full-/Part-time)	157	40.4%	40.4%	1
Housewife/househusband	27	6.9%	47.3%	4
Pensioner	61	15.7%	63.0%	3
Retired	13	3.3%	66.3%	6
Student	4	1.0%	67.3%	7
Unemployed	112	28.8%	96.1%	2
Own business	15	3.9%	100%	5
Total	389	100%		

Table 3. General information of households.

Description	No. of Participants	Percentage	Cumulative %	Rank
Income [1]				
Low income	202	51.9%	51.9%	1
Lower-middle income	103	26.5%	78.4%	2
Middle income	53	13.6%	92.0%	3
Upper-middle income	24	6.2%	98.2%	4
High income	7	1.8%	100%	5
House ownership				
Owned by family/friend	45	11.6%	11.6%	2
Owned by government	23	5.9%	17.5%	3
Owned by myself	2.7	53.2%	70.7%	4
Owned by private landlord	114	29.3%	100%	1
Number of family members				
Single member	19	4.9%	4.9%	3
2–5 members	252	64.8%	69.7%	1
6–9 members	111	28.5%	98.2%	2
10 and more members	7	2.0%	100%	4
Years living in neighborhood				
Less than a year	21	5.4%	5.4%	5
1–5 years	89	22.9%	28.3%	3
5–10 years	100	25.7%	54.0%	2
10–20 years	131	33.7%	87.7%	1
More than 20 years	48	12.3%	100%	4
Total	389	100%		

[1] We adopted the standard household income brackets defined by the South African government.

The majority of heads of households in South African townships are young (<45 years old) and female, with secondary/high school education or less. In total, 40.4% of heads of households are employed (full/part time), while 28.8% are unemployed, and 15.7% of them are pensioners. The predominant head of households are employed either full time or part time (40.4%) within the low-income bracket as listed in Table 3.

As shown in Table 3, most households in the South African townships fell into the low income (51.5%) and lower-middle income (26.5%) groups, while there were only less than 2% of high income households living in townships thereby indicating that the majority of households in the South African townships earn below the average urban households living outside the townships. The majority of the houses (53.2%) in townships were owned by the head of households with an average small-sized family (two to five members). Moreover, most South African families had been living in these townships from 5 to 20 years.

4.2. Current Housing, Neighborhood, and Wellbeing Attributes

As presented in Figure 4, the general condition of houses in South African townships are inadequate, since most houses do not contain or have access to basic services such as adequate natural lighting and ventilation, which fails to provide for the needs of their residents (below 50%). As illustrated in Figure 4, the majority of houses do not provide for social needs, such as enough space and privacy for families, and are not connected to a stable internet connection. The most crucial issues of housing in South African townships are the vulnerability of the family to natural and manmade disasters, crime, poor design, and orientation (lack of natural ventilation and light and no open space) primarily due to the absence of standard design, which effects the functionality and resilience of houses and, consequently, the impacts on residents' health and resilience. This confirms Ekpo and Moghayedi's [2] assessment that these townships are characterized by poor, inadequate, and substandard housing that provides no security of tenure for residents and inappropriate housing formations that are usually noncompliant with building or planning regulations [2]. The approach to resilience here helps to explain the institutional path dependence, the ability to deal with danger and threats, and to adapt, impact, and regulate or recover after a disruptive occurrence or a change event [35].

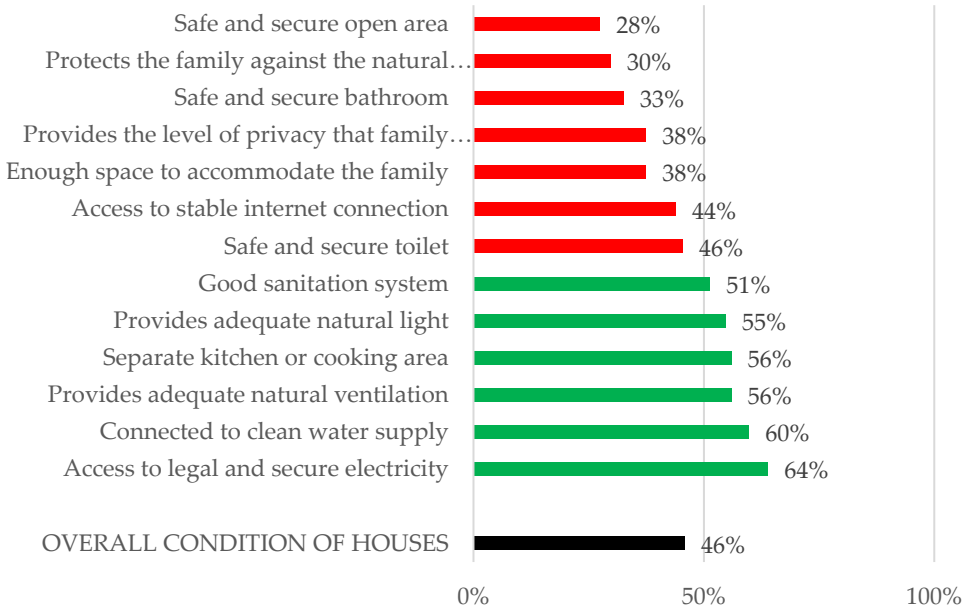

Figure 4. Housing conditions in South African townships. Below 50%: poor; above 50%: sufficient.

The safety and security in South African townships are a critical concern, since only 15% of participants feel they are living in a safe and secure neighborhood, and these neighborhoods are not protecting families against disasters (23%). Moreover, the low inclusivity and lack of open communal/public spaces in the neighborhood are another poor aspect of townships, which significantly influences the resilience of township communities and neighborhoods. This is also evident from Olsson et al. [37], who state that adaptive resilience usually emerges in incorporating the social and empirical aspects of sustainability. As shown in Figure 5, the overall neighborhood conditions of South African townships are extremely poor (44%).

As with the housing and neighborhood conditions, the overall wellbeing of South African township communities is low (49%), as illustrated in Figure 6. The financial unsustainability and unsafe living conditions in townships are the two most critical wellbeing issues in South African townships due to a high unemployment rate and low level of income in these neighborhoods, as presented in Table 2. Moreover, the lack of help and support with care in these townships is another critical wellbeing issue in South Africa.

This significantly reduces the level of wellbeing and resilience in both individuals and the community. This aligns with Mahomed and Pretorius's [56] study that "townships and rural areas endure difficult circumstances such as poverty, unemployment, low educational levels, unstable income sources, socioeconomic deprivation and the lack of transportation". In addition, psychosocial issues such as crime, violence, and substance abuse are additional contextual factors prevalent within South African townships. Serbanica and Constantin [32] connect these to the fact that these resilient neighborhoods use their own resources to enhance the living conditions, for example, by improving air ventilation, water use, and refurbishment based on the mental and physical abilities to improve the quality of life of individuals, families, and communities [44].

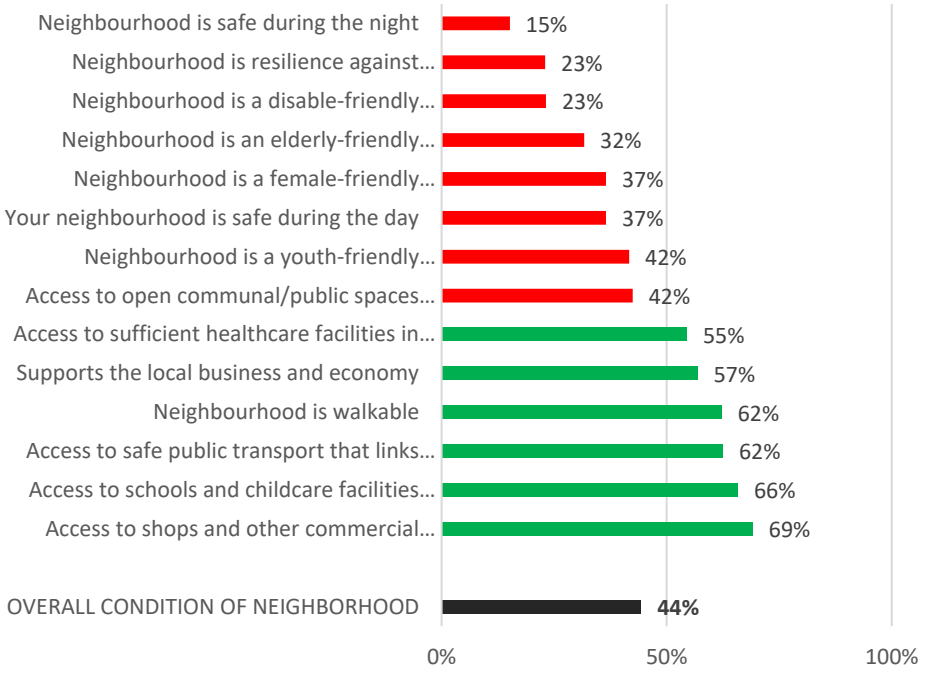

Figure 5. Neighborhood condition of South African townships. Below 50%: poor; above 50%: sufficient.

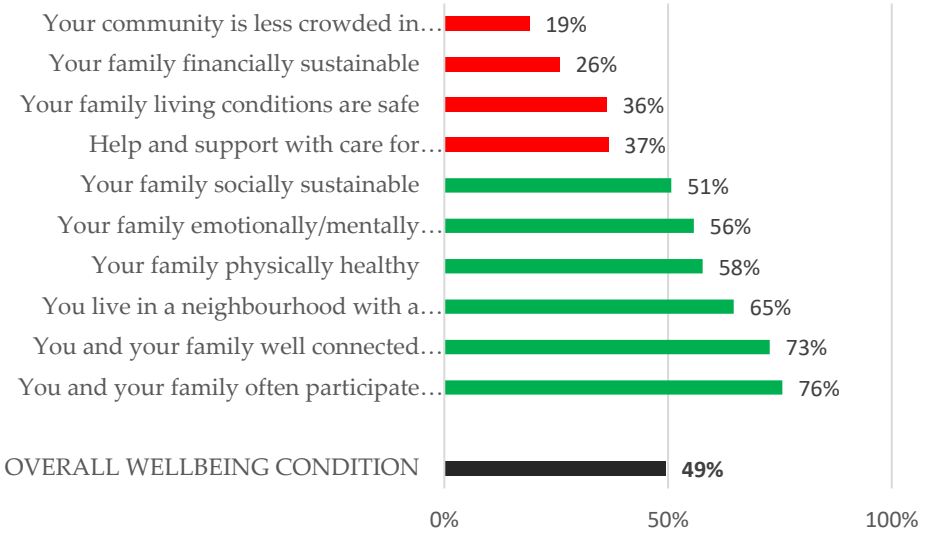

Figure 6. Individual and family wellbeing conditions of South African townships residents. Below 50%: poor; above 50%: sufficient.

4.3. Modeling the Wellbeing of South African Township Neighborhoods

4.3.1. Evaluating the Reliability and Consistency of Model

To evaluate the goodness of fit of the developed model, the reliability, internal consistency, and the discriminant, convergent, and divergent validity of the constructs and subconstructs (variables) were evaluated. Convergent validity exhibited the level of association between the subconstructs of the construct, if the average variance of the construct was higher than 0.5. Discriminant validity was recognized when there was a strong association between the constructs or subconstructs of the model (average variance > 0.7). Moreover, the composite reliability was also higher than recommended value of 0.7 as shown in Table 4.

Table 4. Reliability and consistency of the modeling components.

Construct	Number of Subconstructs	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted
Household socioeconomic characteristics	8	0.879	0.923	0.931	0.925
House conditions	13	0.821	0.864	0.899	0.772
Neighborhood conditions	10	0.839	0.847	0.868	0.766
Wellbeing	7	0.802	0.794	0.824	0.730

The reliability and consistency test results, the average variance, and the Cronbach's alpha coefficient validated the model's goodness of fit, as presented in Table 4. The Cronbach's alpha of the constructs was greater than 0.70, indicating the collected data's high reliability. The high value of the average variance (>0.5) suggests that the constructs and subconstructs had sufficient internal consistency and validity. T statistics were used to test the five formulated hypotheses. As presented in Table 5, the *p*-values of the research hypotheses were less than 0.05, which proved all the formulated hypotheses were statistically significant.

Table 5. Statistics' test results.

Hypothesis	Path Coefficient	T Statistics	*p* Values
Significant association between the household socioeconomic characteristics and the housing features	0.201	5.12	0.001
Significant association between the neighborhood features and the housing features	0.576	18.99	0.001
Significant association between the housing features and the wellbeing attributes	0.417	4.135	0.000
Significant association between the household socioeconomic characteristics and the wellbeing attributes	0.448	3.927	0.001
Significant association between the neighborhood features and the wellbeing attributes	0.514	12.452	0.001

The results from the testing of the hypotheses deduced that the individual and family wellbeing of people living in South African townships are significantly associated with household socioeconomic characteristics and housing and neighborhood features. Moreover, the hypotheses testing results proved that the housing features were positively correlated to the household socioeconomic characteristics and neighborhood features of the townships.

4.3.2. Analysis of the Structural Equation Model

After showing that all the formulated hypotheses were valid, the path model for the developed wellbeing framework was developed. As illustrated in Figure 7, four constructs and 38 subconstructs with satisfactory relationships with the constructs (loading factors greater than 0.6) were used in the path analysis.

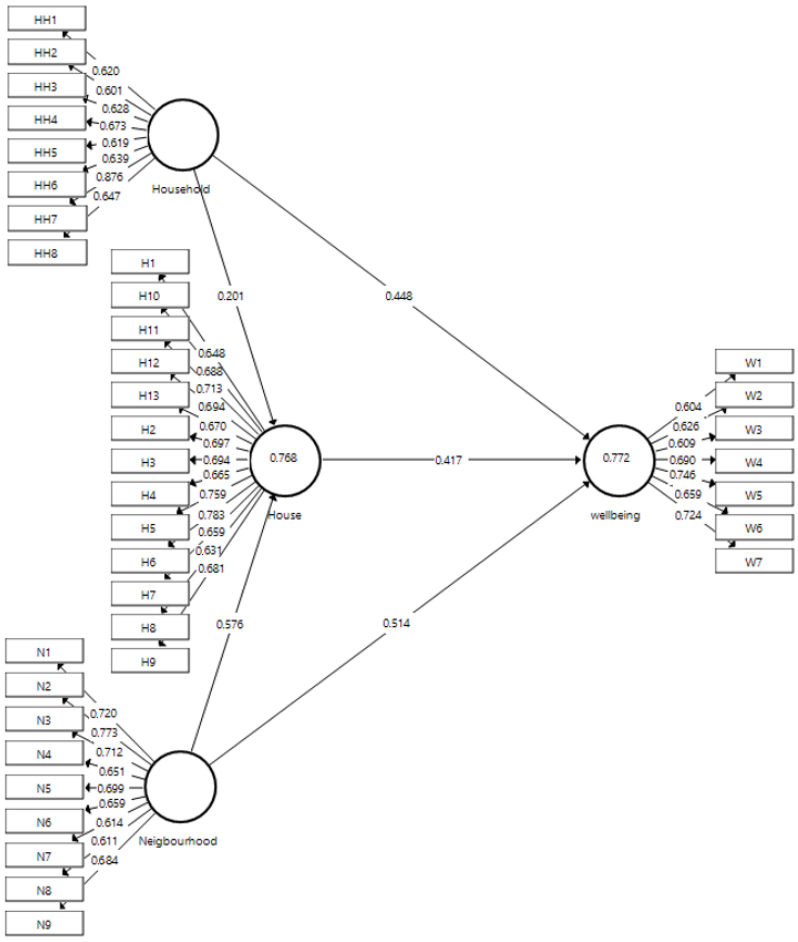

Figure 7. Neighborhood wellbeing path diagram.

The R squared of the housing features (0.768) and wellbeing attributes (0.772) was above 0.5, which means high positive correlations existed between the developed model's dependent and independent constructs. Furthermore, all the other fitness of the model indicators were within the recommended values (x^2 = 1756.720; x^2/dF = 4.695; p = 0.001, RMSEA = 0.038, CFI = 0.892; GFI = 0.875, RMSEA < 0.5). Therefore, we can deduce that the model fit the collected data, and the results validated the wellbeing framework in South African townships.

The path model (Figure 7) demonstrates that the neighborhood conditions significantly affect the wellbeing of individuals and families in South African townships (0.514). These findings are aligned with earlier findings such as those of Ekpo and Moghayedi [2] and Mahomed and Pretorius [56] who argued that townships and rural areas are confronted by arduous circumstances. The wellbeing and health of the housing occupants is not only defined by infrastructural enhancement and tenure security but also in terms of environmental neighborhood characteristics and structural design attributes [10]. These results also prove that the conditions of housing provision in the global south are associated with the socioeconomic status of neighborhoods, as they concluded that the housing conditions in low-income neighborhoods were remarkably low compared to the similar middle- and high-income neighborhoods. These relationships confirmed the critical role (directly and indirectly) of the neighborhood conditions on the wellbeing of South African townships and their residents.

The path model also shows that while the influence of a households' socioeconomic characteristics on housing conditions is minimal, the direct effect of these factors on the wellbeing of individuals and families in South African townships is remarkably high (0.448). This is mainly because of the direct and indirect (via housing conditions) effects

of the household characteristics on both the physical and mental wellbeing of individuals and families and, thus, their resilience. Qiu et al. [18] showed that the socioeconomic characteristics of households are the most critical factors constituting the wellbeing and resilience of families and individuals.

To have a clear picture of the total effect of the three constructs on the wellbeing and, consequently, the resilience of individuals and families living in South African townships, the total effects of the study constructs are illustrated in Figure 8.

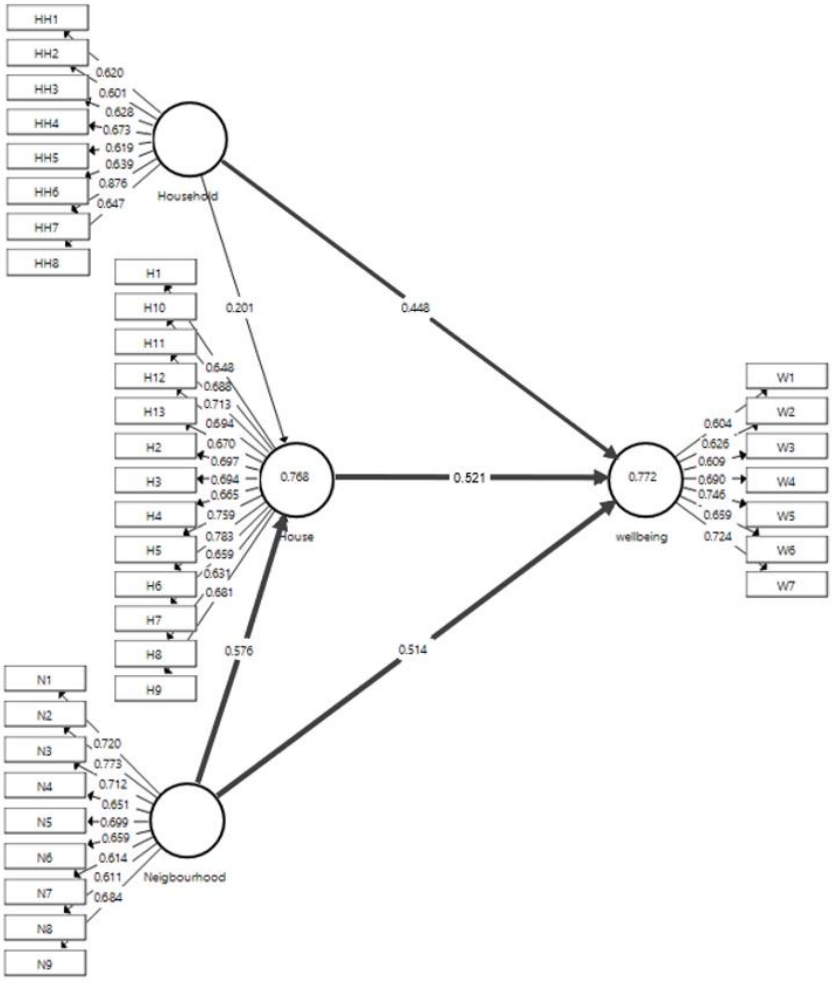

Figure 8. Neighborhood wellbeing total effect path diagram.

Figure 8 shows the total effect coefficient among the constructs. The results of the total effect coefficient reveal the mediating impacts of the household socioeconomic characteristics and the neighborhood features of townships on the individual's and family's wellbeing through the housing features.

Furthermore, both the direct path and the total effect path diagrams proved that the effect of neighborhood features on the wellbeing of individuals and families were considerably higher than the effects of the socioeconomic characteristics of the household and the housing features on wellbeing and resilience in South African townships. Zeng et al. [28] and Marchese et al. [35] found similar results, suggesting the macroenvironmental factors are the main drivers of wellbeing and resilience.

Lastly, the outer weights of the household, housing, neighborhood, and wellbeing were calculated and ranked based on the relative importance to each subconstruct in Table 6. Outer weights assess the subconstructs' relative importance within each construct in formative measurement models.

Table 6. Outer weights of the subconstructs.

Variables (Subconstructs)	Household	House	Neighborhood	Wellbeing
Level of income	0.217			
Size of family	0.199			
Job of head of household	0.174			
House ownership	0.153			
Age of head of household	0.114			
Sex of head of household	0.108			
Education of head of household	0.097			
Duration of living in the neighborhood	0.065			
Connection to clean water		0.182		
Connection to safe sanitation system		0.175		
Has a private and safe toilet		0.166		
Connection to electricity		0.146		
Has a private and safe bathroom		0.135		
Has enough space to accommodate the family		0.131		
Privacy in the house		0.127		
Disaster resistant		0.122		
Has a kitchen or separate cooking area		0.111		
Appropriate natural ventilation		0.107		
Adequate natural light		0.103		
Has a secure and safe open area		0.092		
Connection to stable internet connection		0.045		
Safe and secure			0.201	
Access to safe and inclusive public transport			0.194	
Access to healthcare facilities			0.187	
Access to schools and childcare facilities			0.162	
Protects community against disasters			0.160	
Inclusivity			0.144	
Supports the local economy and business			0.132	
Access to shops and other commercial amenities			0.115	
Walkable			0.102	
Access to open communal/public spaces			0.089	
Living in a safe environment				0.312
Emotionally/mentally healthy				0.298
Physically healthy				0.290
Financially sustainable				0.273
Access to necessary help and support with care				0.241
Socially sustainable				0.200
Being part of community				0.164

As listed in Table 6, the outer weights of the subconstructs of the constructs were remarkably close, which indicates the importance of all the identified subconstructs on wellbeing. While many scholars [2,18,30] emphasize the influence of the socioeconomic characteristics of households on the wellbeing and resilience of individuals and families, the outer weights of the households' characteristics indicated that the level of income, size of the family, and job of the head of household were the three most crucial household subconstructs that influence individuals' and families' wellbeing in South African townships. This finding is in line with the earlier research undertaken by UN Habitat [30], which acknowledged households' ability to resist and withstand situations of crises [30].

The close range of the outer weights of the housing features proved that all the housing design elements and the essential facilities of houses, such as a connection to clean water, a safe sanitation system, and a private and safe toilet, directly affect the physical and mental wellbeing of the residents in townships.

Since the most predominant subconstructs in the neighborhood conditions and wellbeing were a safe and secure neighborhood and living in a safe environment (Table 6), it is

evident that safety and security are crucial factors affecting individuals' and families' well-being in South African townships. Despite the fact that safety and security are fundamental human desires and are vital pillars of any sustainable community and social system [57], the high level of crime and incidents in South African low-income neighborhoods leads to the increased vulnerability and low resilience of residents within these neighborhoods and exaggerates the influence of safety and security on wellbeing.

5. Conclusions

The issue of physical and mental wellbeing at individual and family levels in low-income neighborhoods is a major concern in South Africa and other developing countries. Therefore, this research empirically examined the associations between household socioeconomic, housing, and neighborhood conditions and the wellbeing of South African townships using the wellbeing framework developed by Moghayedi et al. [1]. The study of households, housing, neighborhoods, and wellbeing conditions in South African townships and modeling their associations validated the significant positive direct and mediating (through housing conditions) impacts of the household socioeconomic characteristics and the neighborhood situations on the wellbeing of individuals and communities in South African townships.

The study's findings proved that poverty-stricken households, inadequate housing conditions, and the unsafe and insecure situation of neighborhood facilities are the primary reasons for the low quality of life and poor physical and mental wellbeing of individuals and families in South African townships, which leads to the low resilience of residents in these townships. These findings make it possible to conclude that the level of wellbeing and resilience of individuals and families in South African townships depends on not only household socioeconomic characteristics, such as the level of income and size of the family, but primarily depends on the condition of neighborhoods, particularly the level of safety and security and the availability of essential services and amenities within houses and the access to necessary urban infrastructure in the neighborhood. Hence, housing conditions as micro aspects and household socioeconomic characteristics and neighborhood conditions as macro aspects are interrelated, and both aspects significantly affect the wellbeing of individuals and communities. Therefore, to address issues in townships and enhance the quality of life of inhabitants and communities, both the micro and macro aspects in South African townships must be improved concurrently. Furthermore, it can be concluded from the findings of this study that enhancing the wellbeing of townships through improvements in both micro and macro aspects will subsequently lead to improvements in the resilience of individuals and communities living in these townships. Hence, the knowledge, strategies, and mechanisms for improving wellbeing and resilience should spread among all stakeholders. Therefore, policymakers, designers, and developers must ensure that the executives involved and their organizations become conversant with the complex issue of wellbeing in South African townships and ensure that all parties acquire the necessary understanding to evaluate the condition of households, housing, and neighborhoods using data-driven empirically based assessment frameworks. This approach will empower them to develop an optimal sustainable mechanism to address the wellbeing and resilience of a particular township and avoid a one-size-fits-all approach, which can be at odds with the needs and conditions of various townships.

The validation of the wellbeing framework in South African townships attests to its applicability as a mechanism for enhancing individual and community wellbeing in low-income neighborhoods in cities of the global south. This study provides several practical and theoretical inferences for practitioners and researchers. In practice, the validated wellbeing framework serves as a roadmap for local and national South African policymakers to adopt and implement appropriate policies and plans to improve the wellbeing and resilience of townships. Theoretically, the study divulges the potential for a holistic multilateral solution to the complex challenges in the context of South African townships with opportunities for operationalization in similar neighborhoods in developing country

contexts. Therefore, it can be concluded that the neighborhood's wellbeing framework is appropriate for evaluating neighborhood conditions and wellbeing and strongly suggests possible upgrading solutions to improve the wellbeing and resilience in South African townships or similar neighborhoods in cities of the global south.

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Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical restrictions.

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